PRECISION POWER
PRECISION POWER
PRECISION POWER
PRECISION POWER
PRECISION POWER
PRECISION POWER
PRECISION POWER
PRECISION POWER
PRECISION POWER

INSTRUCTION MANUAL

PRECISION POWER
PRECISION POWER
PRECISION POWER
PRECISION POWER
PRECISION POWER
PRECISION POWER
PRECISION POWER
PRECISION POWER

Control Relay in

ADDENDUM

SERIES PIP704 MANUAL ADDENDUM

DOCUMENT NUMBER: 618-119-90

MODEL NUMBER: PIP704-3-105

DESCRIPTION OF FEATURES: This is a modified standard Model PIP 704-3 that has the following special features and/or options:

* It has 135 VAC and 270VAC dual range capabilities.

The added range switch is located inside the oscillator mounted on the Processor Board behind the front panel. It can be accessed by powering down the system and sliding the oscillator partially out of the cavity. The switch should be set to the right for the 135 volt range and to the left for the 270 volt range.

Please refer to the standard sections of this manual for additional electrical specifications and programming instructions.

Date: October 21, 1990

Elgar Corporation
9250 Brown Deer Rd
San Diego, CA 92121

This is an insert into the standard Model 9023 Series Instruction Manual.

SERIES PIP704 MANUAL ADDENDUM

DOCUMENT NUMBER:

MODEL NUMBER: *PIP704-3 & PIP704-3T*

DESCRIPTION OF FEATURES:

The Models PIP704-3 and PIP704-3T are Plug-In Programmable Oscillators similar to Elgar Model PIP9023. The Series 704 has additional features that allow testing of the parameters of MIL-STD-704A, B, C, and D.

GENERAL DESCRIPTION

The Elgar Series PIP704 Plug-In-Programmer (PIP) is a solid state instrument intended for use in Automatic Test Equipment (ATE) systems. In response to digitally coded command inputs from a system controller, the PIP produces output signals which are, in turn, inputs to AC power sources. The series PIP704 programs Frequency, Independent Amplitudes, Total Harmonic Distortion (to 8% THD) and Phase Angles of a three phase power source. Model PIP704-3T also has a built-in measurement system that is capable of measuring the output voltage, load current, load watts, frequency and phase angle of its associated power source.

Refer to sheet 2,3 for specifications and sheet 4-9 for operation and other features.

DRAWINGS ATTACHED

MAIN PCB ASSY	5809230-01
MAIN PCB SCHEM	6809230-01
PHASE PCB ASSY	5809231-01
PHASE PCB SCHEM	6809231-01
PROCESSOR PCB ASSY	5809232-01
PROCESSOR PCB SCHEM	6809232-01
TEST PCB ASSY	5809225-01
TEST PCB SCHEM	6809225-01

PIP704-3 & PIP704-3T

April 24, 1990

Elgar Corporation
9250 Brown Deer Rd
San Diego, CA 92121

This is an insert into the standard Model 9023 Instruction Manual.

SERIES PIP704 MANUAL ADDENDUM

PHYSICAL DESCRIPTION

The Series 704 PIP is configured to fit the standard oscillator cavity of all Elgar power sources. It is not intended to be used with the Elgar "C" Series of sources due to isolation problems.

PERFORMANCE SPECIFICATIONS

GENERAL

Input Power:	117VAC, +42VDC and -42VDC from associated Power Source
Output Signal:	0 to 2.5VAC into an 800 ohm load (per phase)
Operating Temp Range:	0 degree C to 50 degree C
Programming:	Local or GPIB per IEEE-488-1978
Distortion (THD):	Less than 1% within power source range

FREQUENCY PROGRAMMING

Frequency Ranges:	45Hz to 999.9Hz in 0.1Hz steps
Frequency Accuracy:	0.001% of set value
Frequency Temco:	0.003% per degree C average 0 to 50 degree C
Frequency Settling Time:	1/2 Cycle or less at new frequency

AMPLITUDE PROGRAMMING

Voltage Ranges:	0 to 200VAC in 0.1VAC steps
Voltage Accuracy:	+/- 0.15% of Full Scale 45Hz to 999.9Hz from 5% of F.S. to F.S.
Amplitude Temco:	+/- 0.01% per degree C average 0 to 50 C
Amplitude Line Regulation:	+/-0.01% for a 10% line change within line operating range.
Amplitude Load Regulation:	+/-0.01% full wave average at point of sense.
Amplitude Settling Time:	Less than 50ms when programming from above 5% of F.S.

SERIES PIP704 MANUAL ADDENDUM

PHASE ANGLE PROGRAMMING

Phase Angle Resolution:	0 to 399 degrees in 0.5 degree steps
Phase Angle Accuracy:	+/-1 deg. from 45Hz to 999.9Hz.

CURRENT LIMIT PROGRAMMING

Range:	5% to 100%
Resolution:	0.01 Ampere
Accuracy:	+/-1% F.S. +/-0.5% reading
Crest Factor:	3.5 to 1 Minimum
Current Temco:	+/-0.02% F.S. +/-0.01 reading per degree C average

MEASUREMENT SYSTEM SPECIFICATIONS (Applies to -3T Model)

VOLTAGE	
Resolution:	0.1VRMS from 0 to 200VRMS
Accuracy:	+/-0.1% F.S. +/-0.05% reading
Temco:	+/-0.01% F.S. +/-0.01 reading per degree C average
CURRENT:	
Resolution	0.01 Ampere from 0 to 20 Amperes
Accuracy	±1.0% FS, ±0.5 % of reading
Crest Factor	3.5 to 1 minimum
Temp Coefficient	±0.02% FS, ±0.01% reading per deg. C average
POWER	
Ranges:	500W, 1KW, 2KW and 4KW
Resolution:	1 Watt
Accuracy:	+/-1% F.S. +/-0.5% reading
Temco:	+/-0.01% F.S. +/-0.02% reading per degree C ave.
FREQUENCY	
Range:	45 to 999.9Hz
Resolution:	1Hz
Accuracy:	+/- 1 digit (1Hz)
Temco:	+/- 1 digit 0 to 50 degrees

SERIES PIP704 MANUAL ADDENDUM

OPERATING INSTRUCTIONS AND SPECIAL FEATURES

All standard instructions for the Model PIP9023 still apply with the exception of "RNG".(The PIP704 has a single 0 to 200 volt range).

SYNCHRONIZATION PULSE OUTPUT

There is a sync pulse available at the rear panel connector J1 of the associated power source that goes low at the start of any programmed aberration for synchronizing test equipment. This is at pin 6 of J1 referenced to pin 1 of J1. This is an open collector with a 3.3 K ohm pull-up.

AMPLITUDE MODULATION INPUT

To modulate the output of the power source with an analog signal, apply a voltage to pin 7 with common to pin 1 of J1 on the rear of the associated power source. The input impedance for this input is 10 K ohms minimum. The scaling for this input is 1% per volt DC or peak AC. Maximum input is 10 volts DC or peak AC which gives up to 10% modulation. Frequency should be held to no more than 30 Hz. There is no disable on this input so if not in use, pin 7 should be shorted to pin 1 in J1 on the rear of the associated power source.

PROGRAMMING EXAMPLES

All of the following commands require that the Model PIP704 be preprogrammed to 400 Hz at 115.0 Volts before starting.

SERIES PIP704 MANUAL ADDENDUM

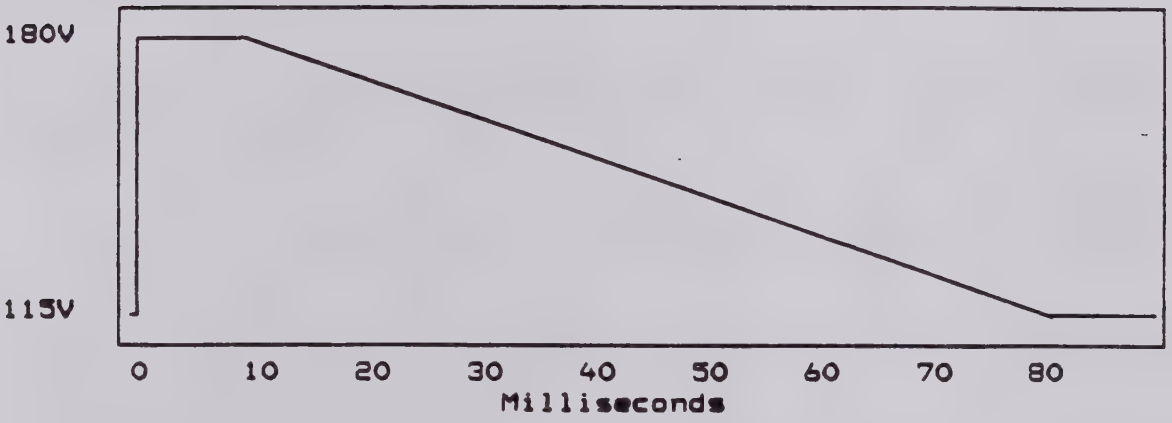
OPERATING INSTRUCTIONS AND SPECIAL FEATURES

PROGRAMMING EXAMPLES

VOLTAGE SURGE COMMANDS

1. To program a surge to 180 volts for 10 ms then linearly ramp to 115 volts in 70 ms:

Remote send;	"SRGVS"	for simultaneous.
	"SRGVA"	for A phase only.
	"SRGVB"	for B phase only.
	"SRGVC"	for C phase only.
Local send;	"V, abc, 2nd, 4"	for simultaneous.
	"V, a, 2nd, 4"	for A phase only.
	"V, b, 2nd, 4"	for C phase only.
	"V, c, 2nd, 4"	for C phase only.



VOLTAGE SAG COMMANDS

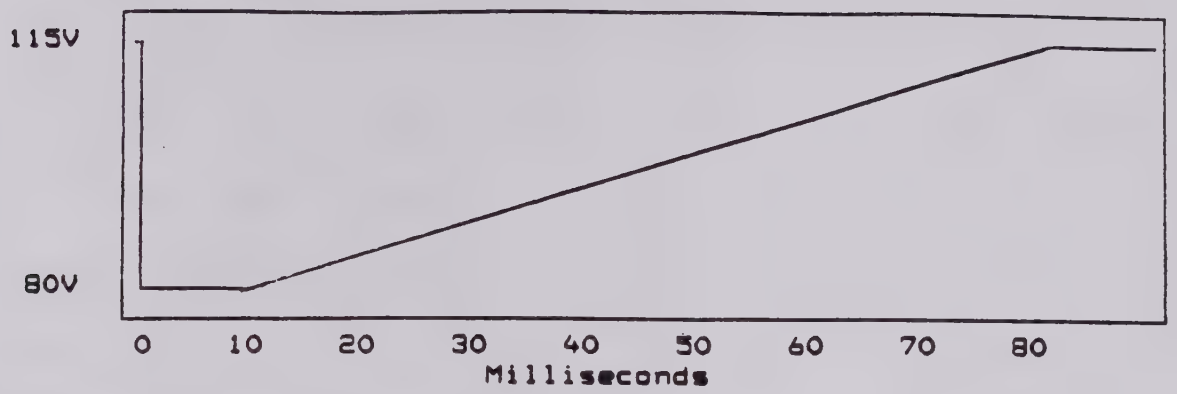
2. To program a sag to 80 volts for 10 ms then linearly ramp to 115 volts in 70 ms:

Remote send;	"SAGVS"	for simultaneous.
	"SAGVA"	for A phase only.
	"SAGVB"	for B phase only.
	"SAGVC"	for C phase only.
Local send;	"V, abc, 2nd, 6"	for simultaneous.
	"V, a, 2nd, 6"	for A phase only.
	"V, b, 2nd, 6"	for B phase only.
	"V, c, 2nd, 6"	for C phase only.

See graph on next sheet.

OPERATING INSTRUCTIONS AND SPECIAL FEATURES

VOLTAGE SAG COMMANDS Continued

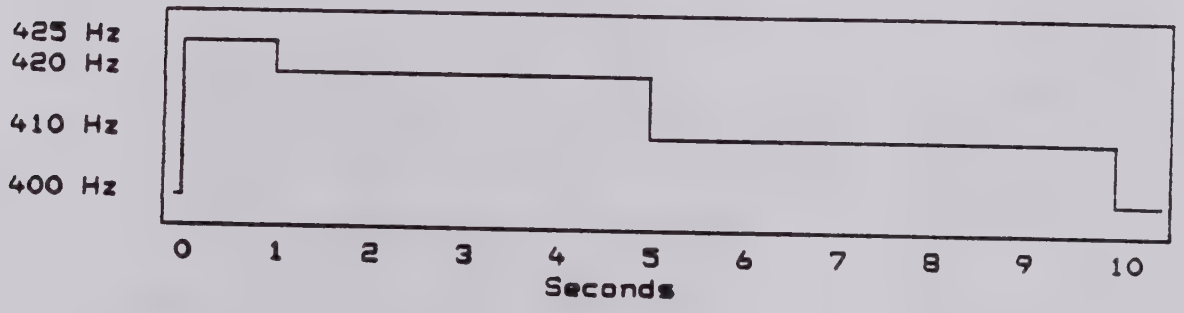


FREQUENCY SURGE COMMANDS

3. To program a frequency surge to 425 Hz for 1 second, drop to 420 Hz for 4 seconds, drop to 410 Hz for 5 seconds and then return to 400 hz:

Remote send; "SRGF" Frequency is always simultaneous.

Local send; "2nd, 7"



SERIES PIP704 MANUAL ADDENDUM

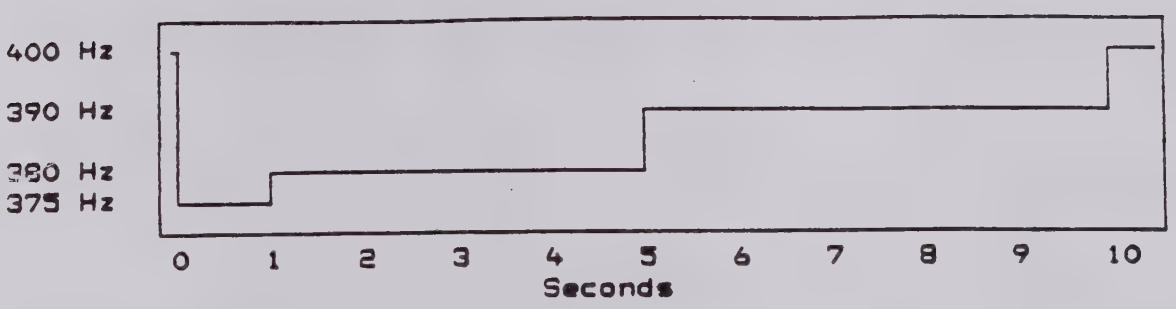
OPERATING INSTRUCTIONS AND SPECIAL FEATURES

FREQUENCY SAG COMMANDS

4. To program a frequency sag to 375 Hz for 1 second, rise to 380 Hz for 4 seconds, rise to 390 Hz for 5 seconds and then return to 400 Hz:

Remote send; "SAGF" Frequency is always simultaneous.

Local send; "2nd, 9"



LINE CYCLE EXCURSION PROGRAMMING

5. To program voltage and/or frequency excursions a method of line cycle counting is available. An excursion of up 9999 cycles may be programmed where the voltage and/or the frequency will deviate to the entered values.

a. The period of the excursion is programmable from 1 to 9999 cycles.
b. The voltage aberration may be to any voltage from zero to 200.0 volts. (To simulate power line dropout it would be programmed to zero for the appropriate number of line cycles).
c. The frequency aberration may be to any frequency from 45 Hz to 999.9 Hz.

Remote entry for this feature is:

"ABBR(w) (xxxx),V (yyyy),f (zzzz)"

(w) is the phase(s) to affect,
S= Simultaneous B= B phase only.
A= A phase only C= C phase only.

(x) is the number of line cycles at the new frequency

(y) is the voltage to go to for the period of (x).

(z) is the frequency to go to for the cycle count period.

SERIES PIP704 MANUAL ADDENDUM

OPERATING INSTRUCTIONS AND SPECIAL FEATURES

LINE CYCLE EXCURSION PROGRAMMING Continued

Example of ABBR(w):

"ABBRS 670,V 160.5,F 380". This would cause the voltage to jump to 160.5 volts and 380 Hz for 670 line cycles (at 380 Hz). At the end of the period it will return to the original voltage and frequency.

If both the voltage and the frequency are to be changed during the aberration period, the voltage must be first in the string as shown in the above example.

Local entry for the aberration feature is:

a. First enter the cycle count by keying in the number into the display, press 2nd then press (a).

b. Next enter the voltage by pressing V, phase(s), enter the aberration voltage, press 2nd, then (b).

c. Next enter the frequency (if it is to be changed) by entering 2nd, F, the frequency, 2nd, then (c).

d. To start the aberration, press 2nd, ENT. The same aberration may be repeated as often as desired by pressing 2nd, ENT.

Example of local entry of ABBR(w):
"0670, 2nd, (a), V, (abc), 160.5, 2nd, (b), 2nd, F, 0380, 2nd, (c)".
This example produces the same output as the remote example.

The voltage and/or the frequency may be updated at any time but if the count is updated, all must be re-entered.

To program a dropout to zero for a specific period such as one millisecond the sequence would be:

"ABBRS 1,V 0,F 1000". This would drop to zero for one cycle at 1 KHz (1 millisecond) and then return to the original voltage and frequency.

SERIES PIP704 MANUAL ADDENDUM

OPERATING INSTRUCTIONS AND SPECIAL FEATURES

DISTORTION COMMANDS

6. To program 8 percent distortion (flat top waveform):
(If the measurement system is installed, the voltage read back will be in error if distortion is programmed).

Remote entry:

"DIST1" Sets the distortion mode. This is only done as a simultaneous operation.

"DIST0" Clears the distortion mode.

Local entry:

Key a 1 into the least significant display and press 2nd and then press 8 to set the distortion mode.

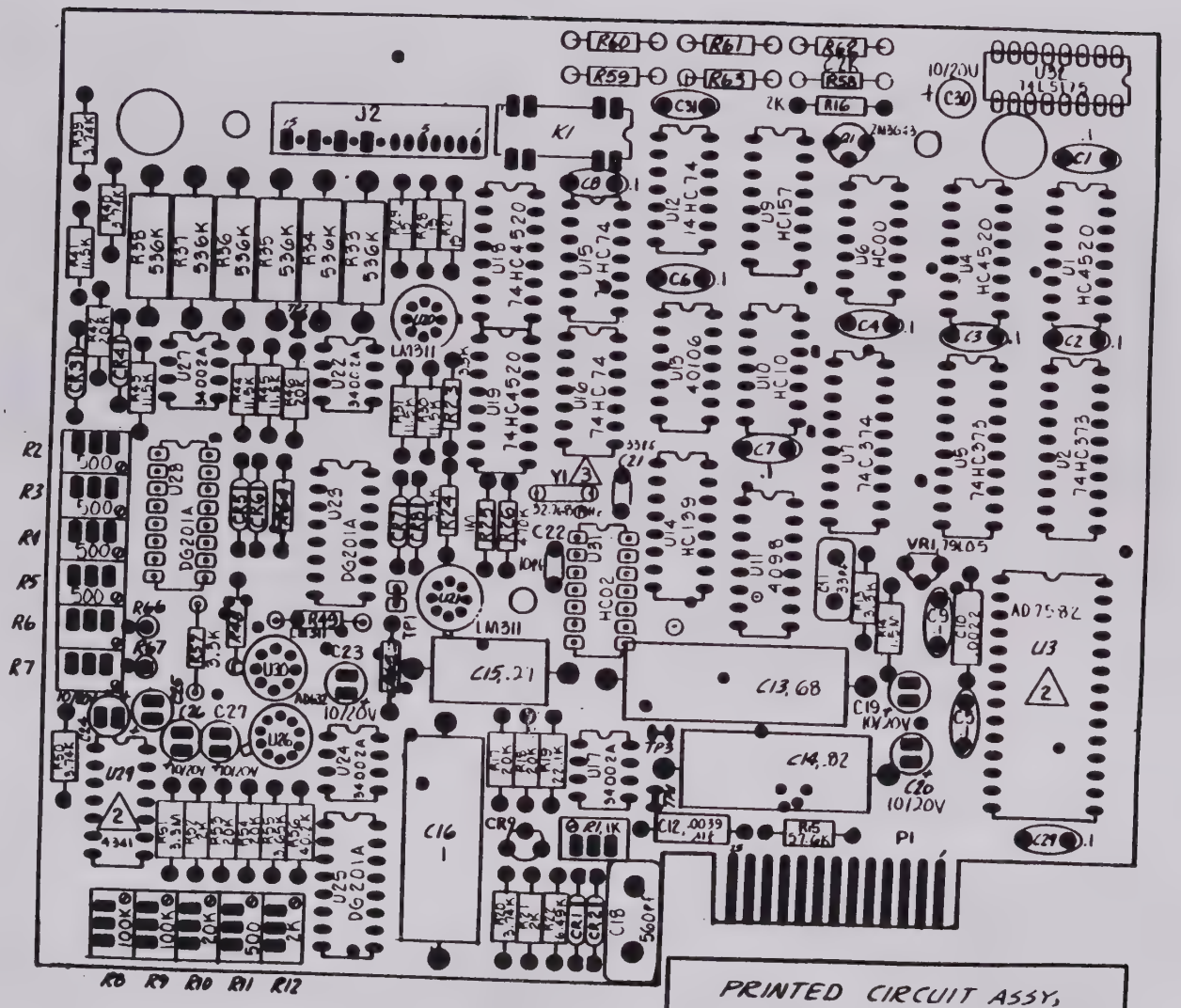
Key a 0 into the least significant display and press 2nd and then press 8 to clear the distortion mode.

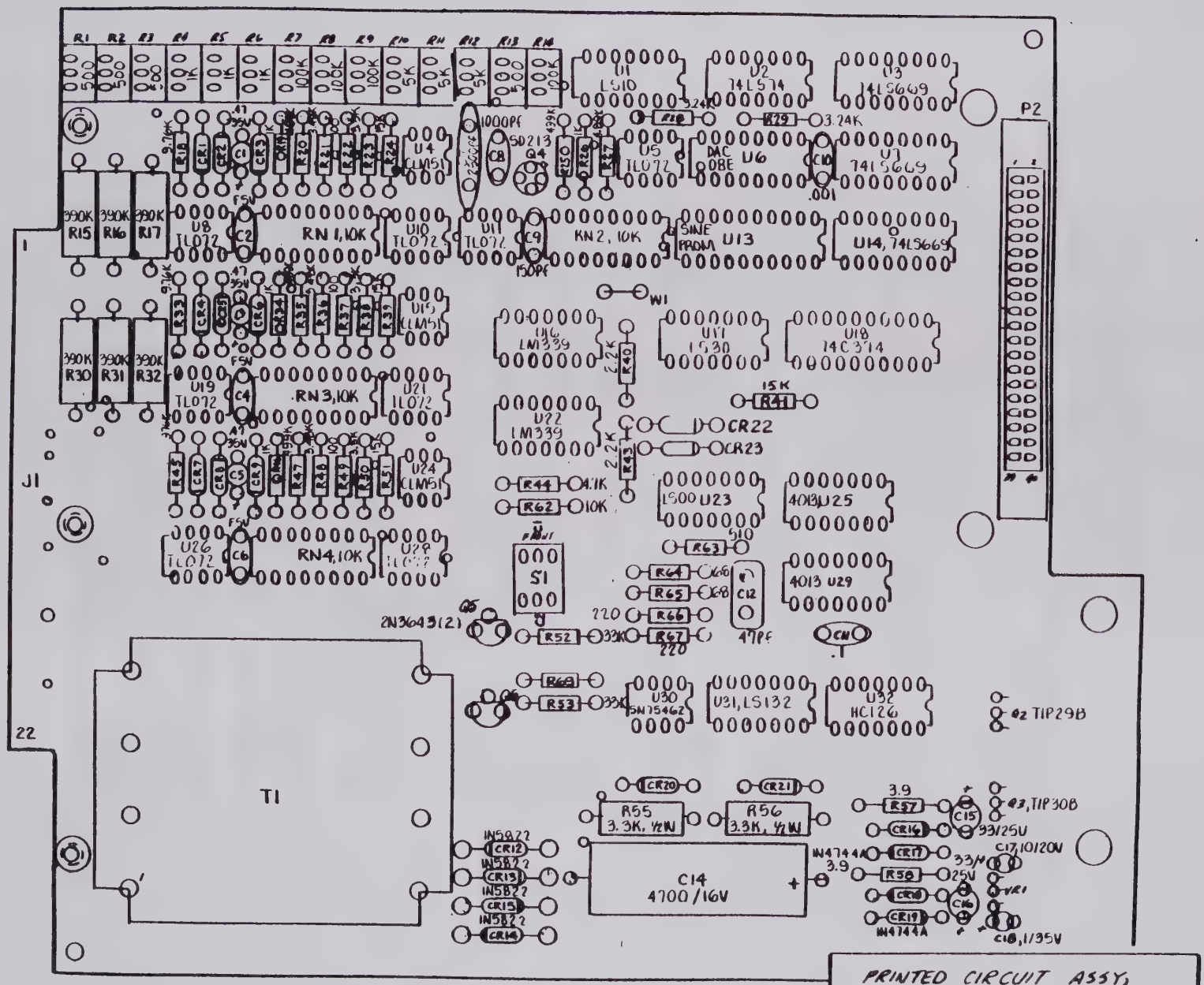
Approximate Harmonic spectrum for the distortion mode is:

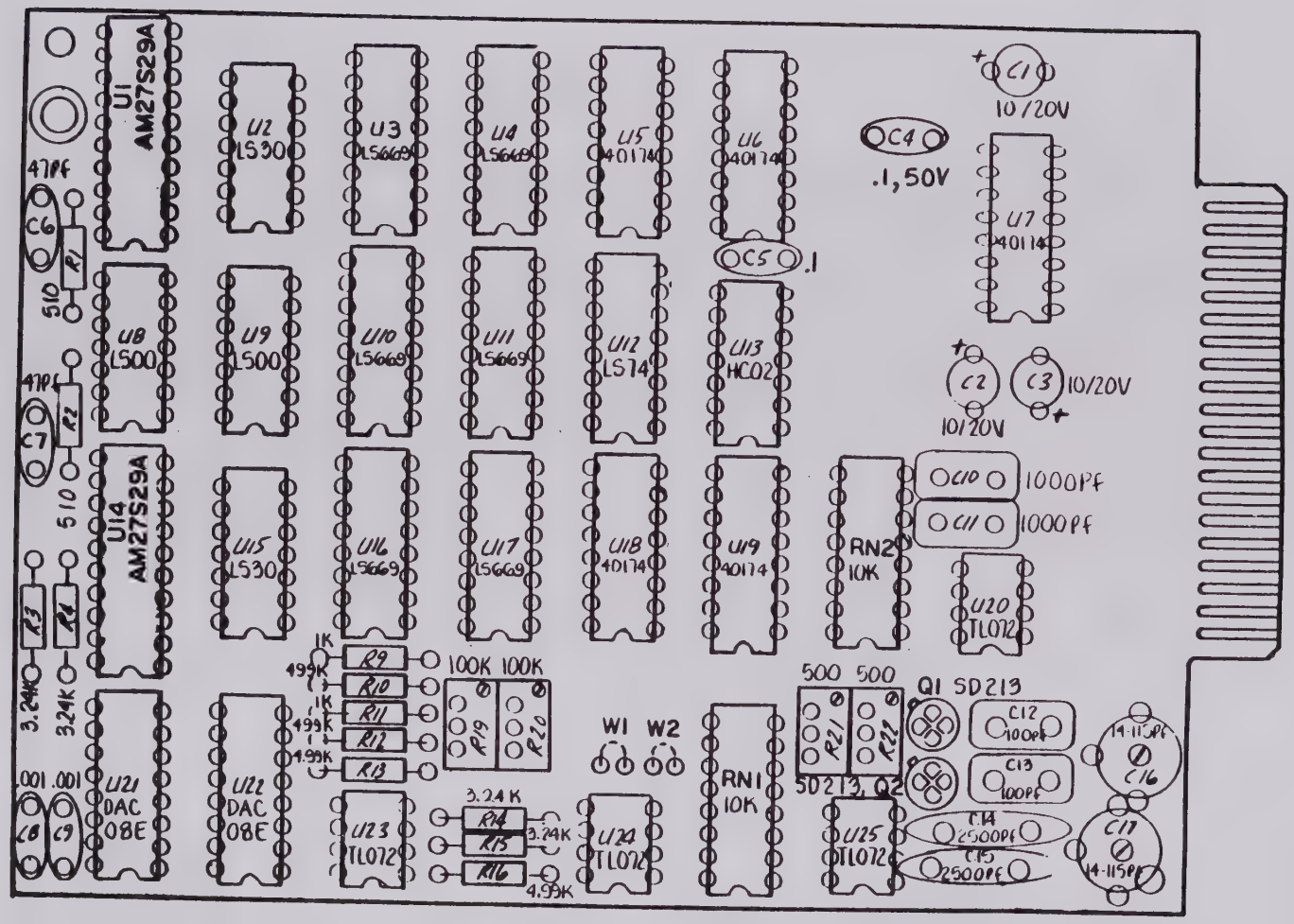
3rd	7.0%
5th	3.6%
7th	0.32%
9th	0.72%
11th	0.63%
13th	0.09%
15th	0.31%

All other harmonics are less than 0.2%.
Even order harmonics are negligible.

Note: Due to the averaging type of operation (Non TRMS) of most of the available distortion analyzers the THD read by them will read about 7% THD. To get an accurate distortion, a Wave Analyzer such as The H.P. 3581A must be used out to at least the 25th harmonic.

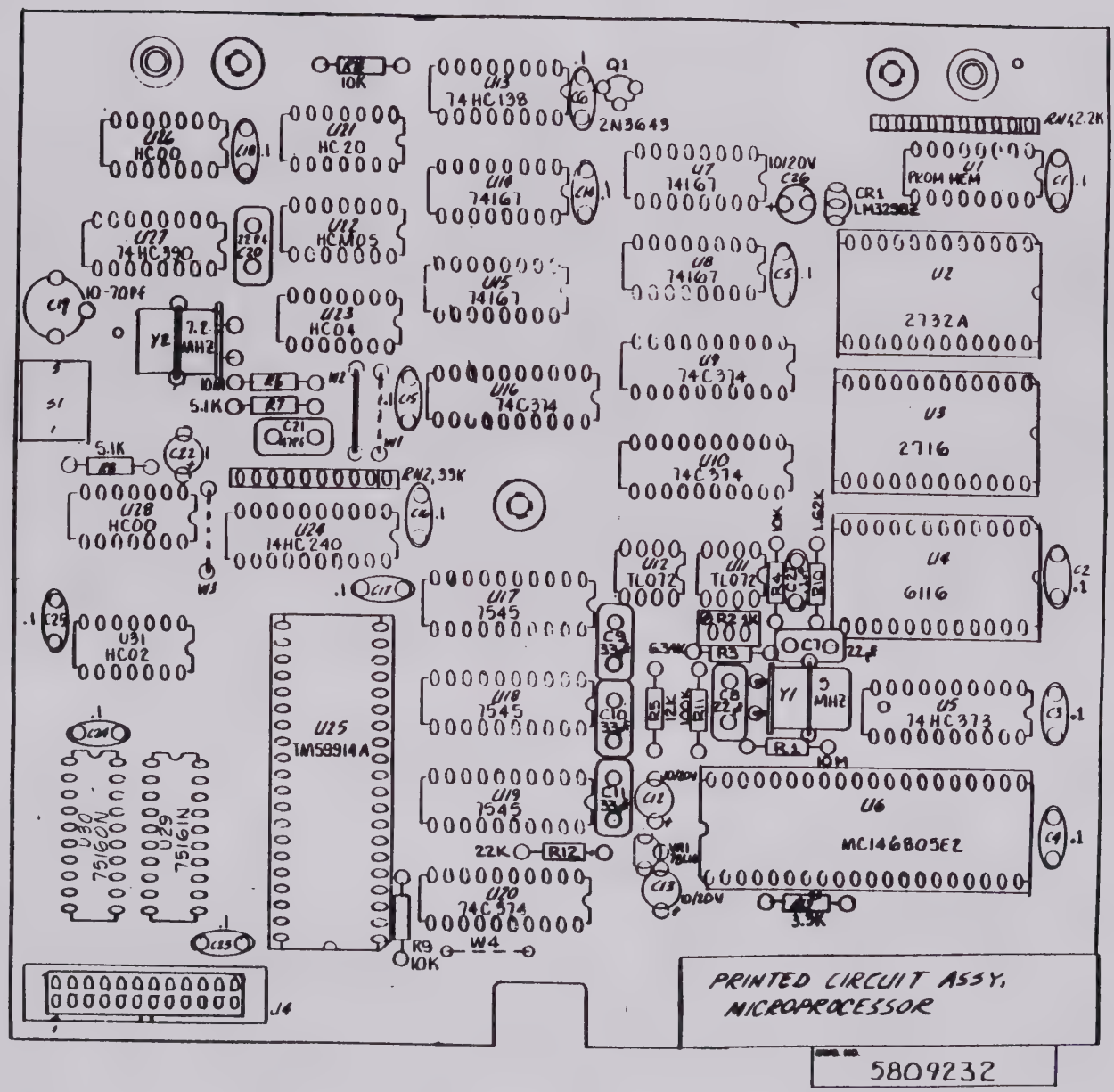

J2
K1
U32
74LS175
2N3643
LM311
74HC4520
74HC74
74HC373
74HC374
4098
DG201A
AD7582
VR1 7905
C15,21
C13,68
C14,82
C16
C18
560pf
PRINTED CIRCUIT ASSY,
TEST BOARD
DRAWING NO.
5809225

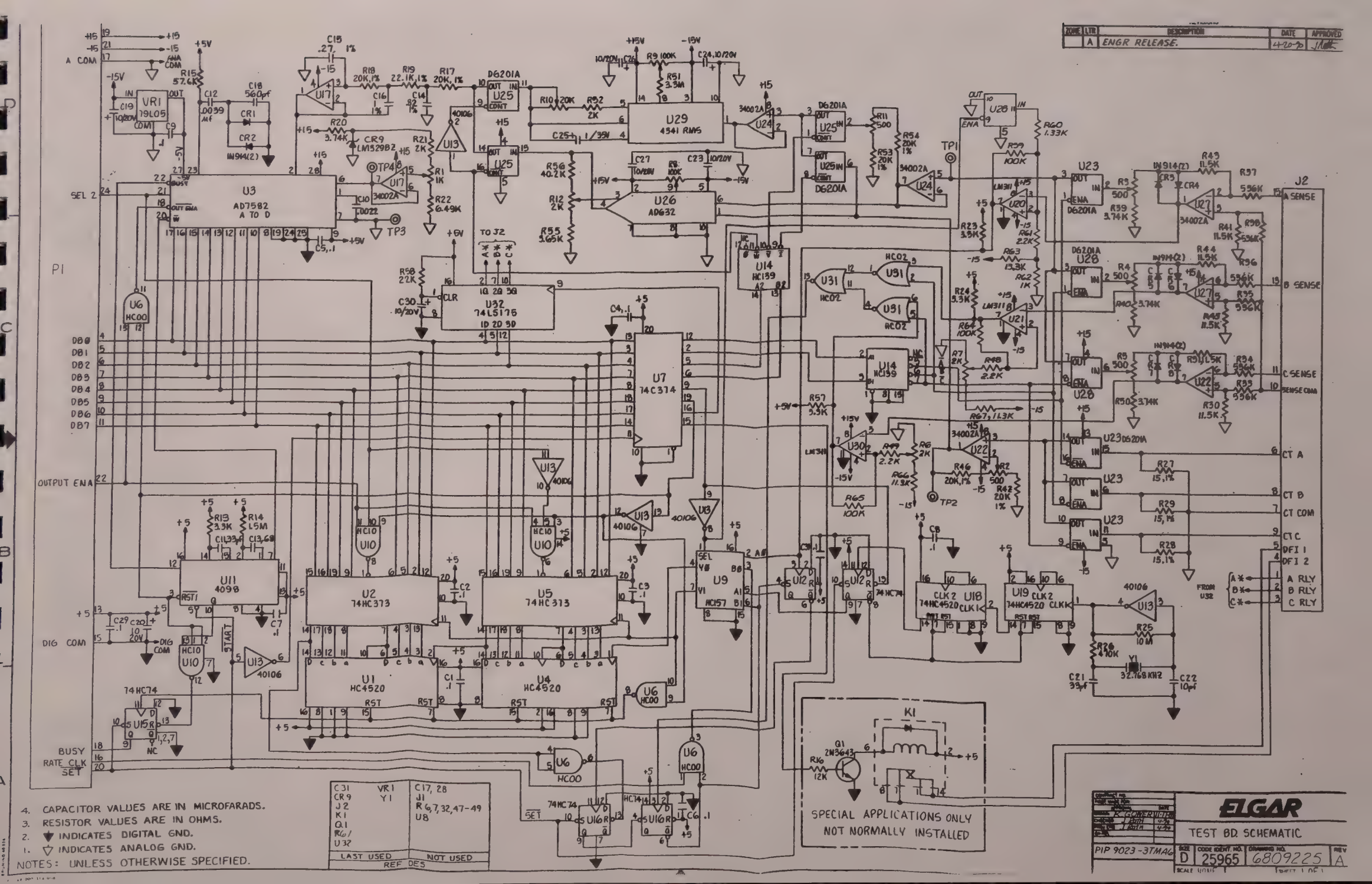

P2
J1
T1
C14
4700/16V
RN1,10K
RN2,10K
RN3,10K
RN4,10K
R55
3.3K, ½W
R56
3.3K, ½W
2N3643(2)
Q2 TIP29B
Q3, TIP30B
S1
W1
CR22
CR23
15K
1000PF
.001
150PF
IN5822
IN4744A
C15
33/25V
C17, 10/120V
C18, 1/35V
VR1
PRINTED CIRCUIT ASSY,
MAIN BOARD, 704
5809230

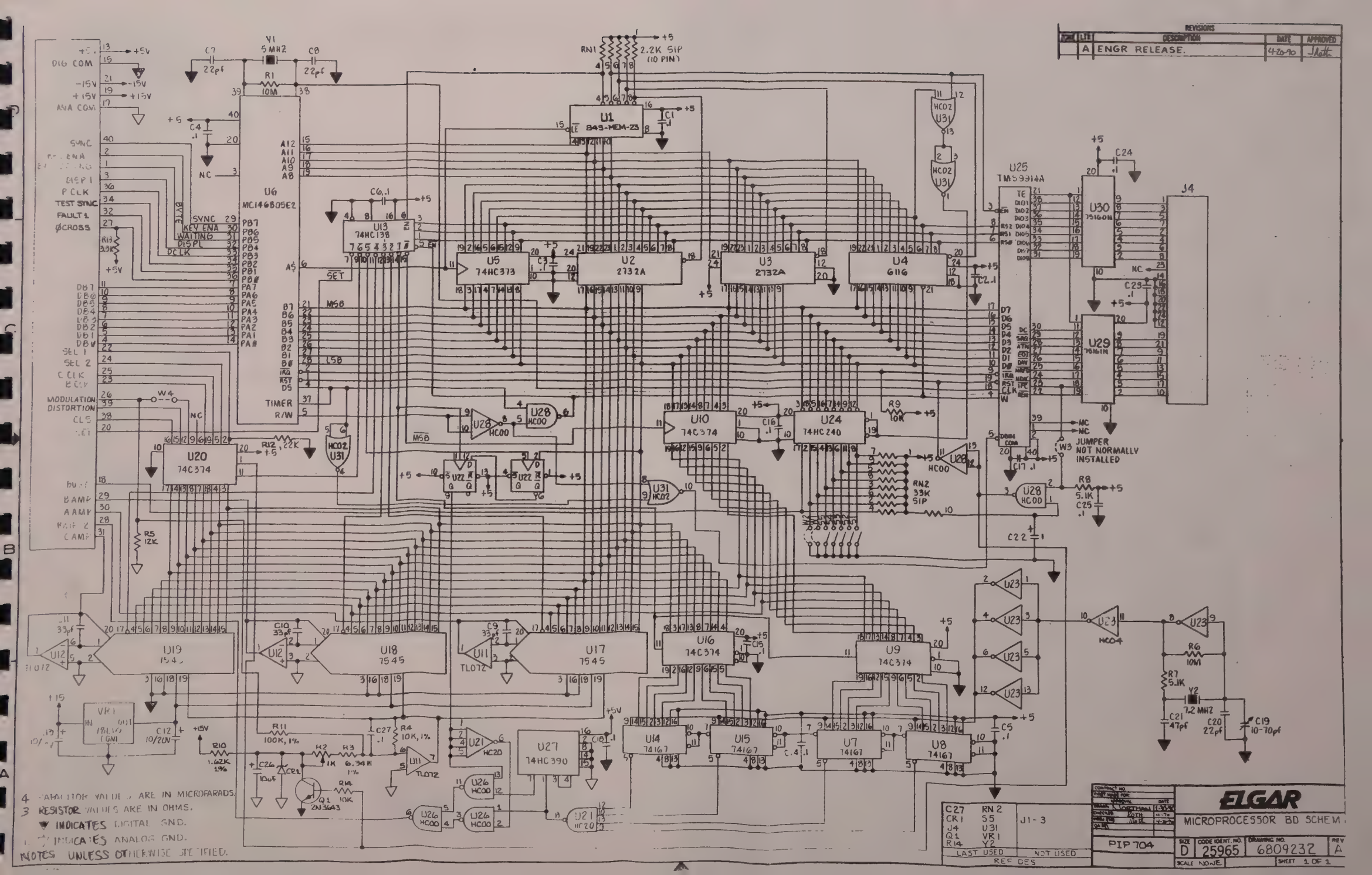


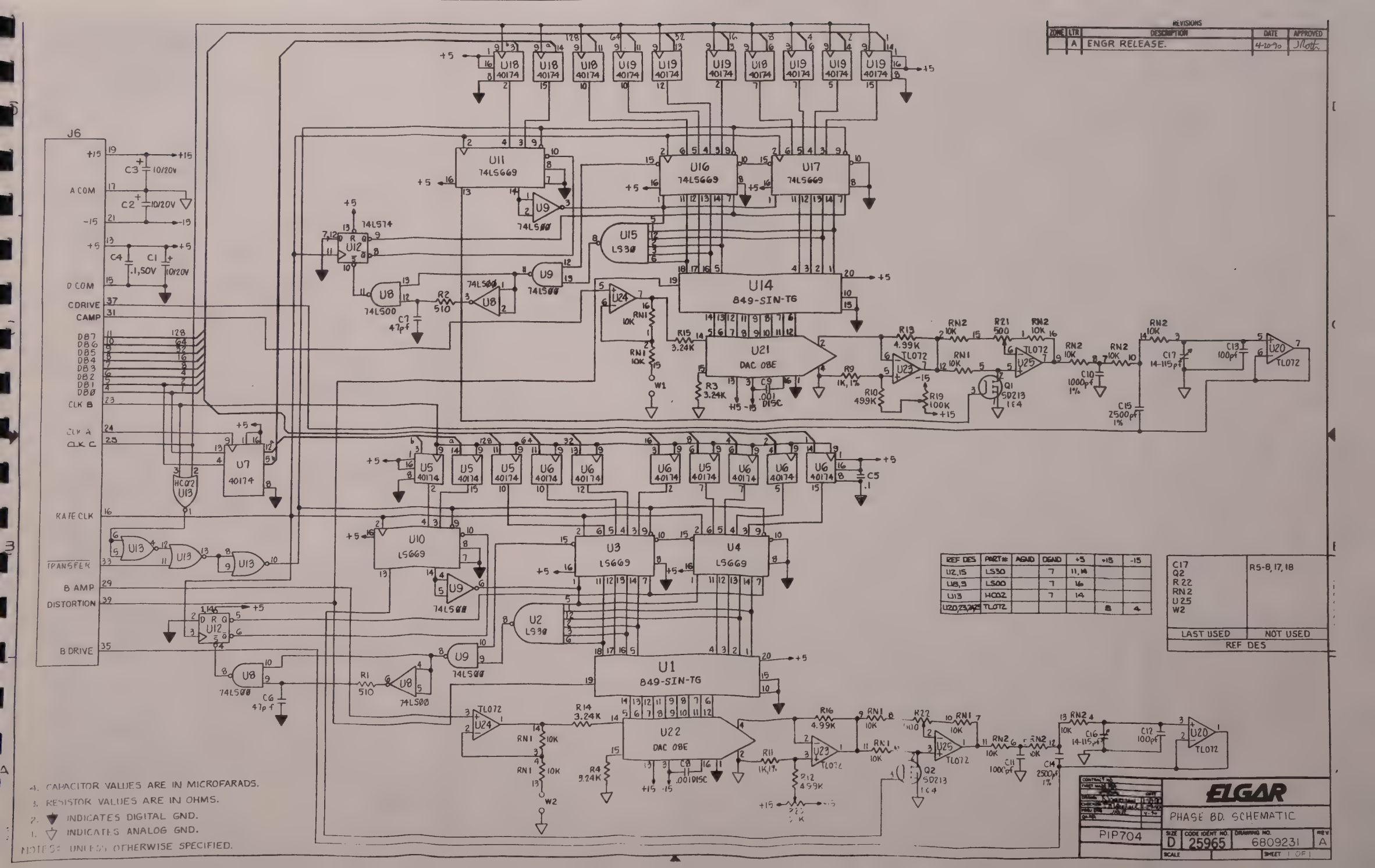
PRINTED CIRCUIT ASSY, PHASE GENERATOR

DWG. NO. 5809231


PRINTED CIRCUIT ASSY, MICROPROCESSOR
5809232


ZONE | LTR | DESCRIPTION | DATE | APPROVED
A | ENGR RELEASE. | 4-20-78
U3 AD7582 A TO D
U29 4541 RMS
U26 AD632
U32 74LS175
U7 74C374
U1 HC4520
U4 HC4520
U2 74HC373
U5 74HC373
U9 HC157
U11 4098
U18 74HC4520 CLK 2
U19 74HC4520 CLK 2
U20 LM311
U21 LM311
U22 LM311
U30 LM311
U31 HC02
U14 HC139
VR1 79L05
U25 D6201A
U24 34002A
U23 D6201A
U28 D6201A
U27 34002A
U13 40106
U6 HC00
U10 HC10
U12 74HC74
U15 74HC74
U16 74HC74
U17 34002A
TO J2
FROM U32
A SENSE
B SENSE
C SENSE
SENSE COM
CT A
CT B
CT COM
CT C
DFI 1
DFI 2
A RLY
B RLY
C RLY
A COM
DIG COM
SEL 2
OUTPUT ENA
BUSY
RATE CLK
SET
START
DB0
DB1
DB2
DB3
DB4
DB5
DB6
DB7
P1
TP1
TP2
TP3
TP4
K1
Q1 2N3643
Y1 32.768 KHZ
SPECIAL APPLICATIONS ONLY
NOT NORMALLY INSTALLED
C31 VR1 C17, 28
CR9 Y1 J1
J2 R6,7,32,47-49
K1 U8
Q1
RG1
U32
LAST USED
NOT USED
REF DES
4. CAPACITOR VALUES ARE IN MICROFARADS.
3. RESISTOR VALUES ARE IN OHMS.
2. ▼ INDICATES DIGITAL GND.
1. ▽ INDICATES ANALOG GND.
NOTES: UNLESS OTHERWISE SPECIFIED.
ELGAR
TEST BD SCHEMATIC
PIP 9023-3TMAG
SIZE D
CODE IDENT NO. 25965
DRAWING NO. 6809225
REV A
SCALE NONE
SHEET 1 OF 1


REVISIONS
ZONE | LTR | DESCRIPTION | DATE | APPROVED
A | ENGR RELEASE. | 4-20-90
U1 849-MEM-23
U2 2732A
U3 2732A
U4 6116
U5 74HC373
U6 MC146805E2
U9 74C374
U10 74C374
U11 TL072
U12 TL072
U13 74HC138
U14 74167
U15 74167
U16 74C374
U18 7545
U19 7545
U20 74C374
U21 HC20
U23 HC04
U24 74HC240
U25 TMS9914A
U26 HC00
U27 74HC390
U28 HC00
U29 75161N
U30 75160N
U31 HC02
J4
Y1 5MHZ
Y2 7.2 MHZ
RN1 2.2K SIP (10 PIN)
RN2 33K SIP
W3 JUMPER NOT NORMALLY INSTALLED
W4
VR1 LM10 (CKT)
Q1 2N3643
CR1
SYNC
KEY ENA
WAITING
DISPL
DCLK
TEST SYNC
FAULT 1
ØCROSS
MODULATION DISTORTION
CLS
SET
TIMER R/W
MSB
LSB
4 CAPACITOR VALUES ARE IN MICROFARADS.
3 RESISTOR VALUES ARE IN OHMS.
▼ INDICATES DIGITAL GND.
△ INDICATES ANALOG GND.
NOTES UNLESS OTHERWISE SPECIFIED.
C27 RN 2
CR1 S5
J4 U31
Q1 VR1
R14 Y2
J1 - 3
LAST USED
NOT USED
REF DES
PIP 704
ELGAR
MICROPROCESSOR BD SCHEM
SIZE D
CODE IDENT. NO. 25965
DRAWING NO. 6809232
REV A
SCALE NONE
SHEET 1 OF 1



REF DES	PART#	AGND	DGND	+5	+15	-15
U2,15	LS30		7	11,14		
U8,9	LS00		7	16		
U13	HC02		7	14		
U20,23,25	TL072				8	4

C17	R5-8,17,18
Q2	
R22	
RN2	
U25	
W2	
LAST USED	NOT USED
REF DES	

4. CAPACITOR VALUES ARE IN MICROFARADS.
3. RESISTOR VALUES ARE IN OHMS.
2. ▼ INDICATES DIGITAL GND.
1. ▽ INDICATES ANALOG GND.

NOTES: UNLESS OTHERWISE SPECIFIED.

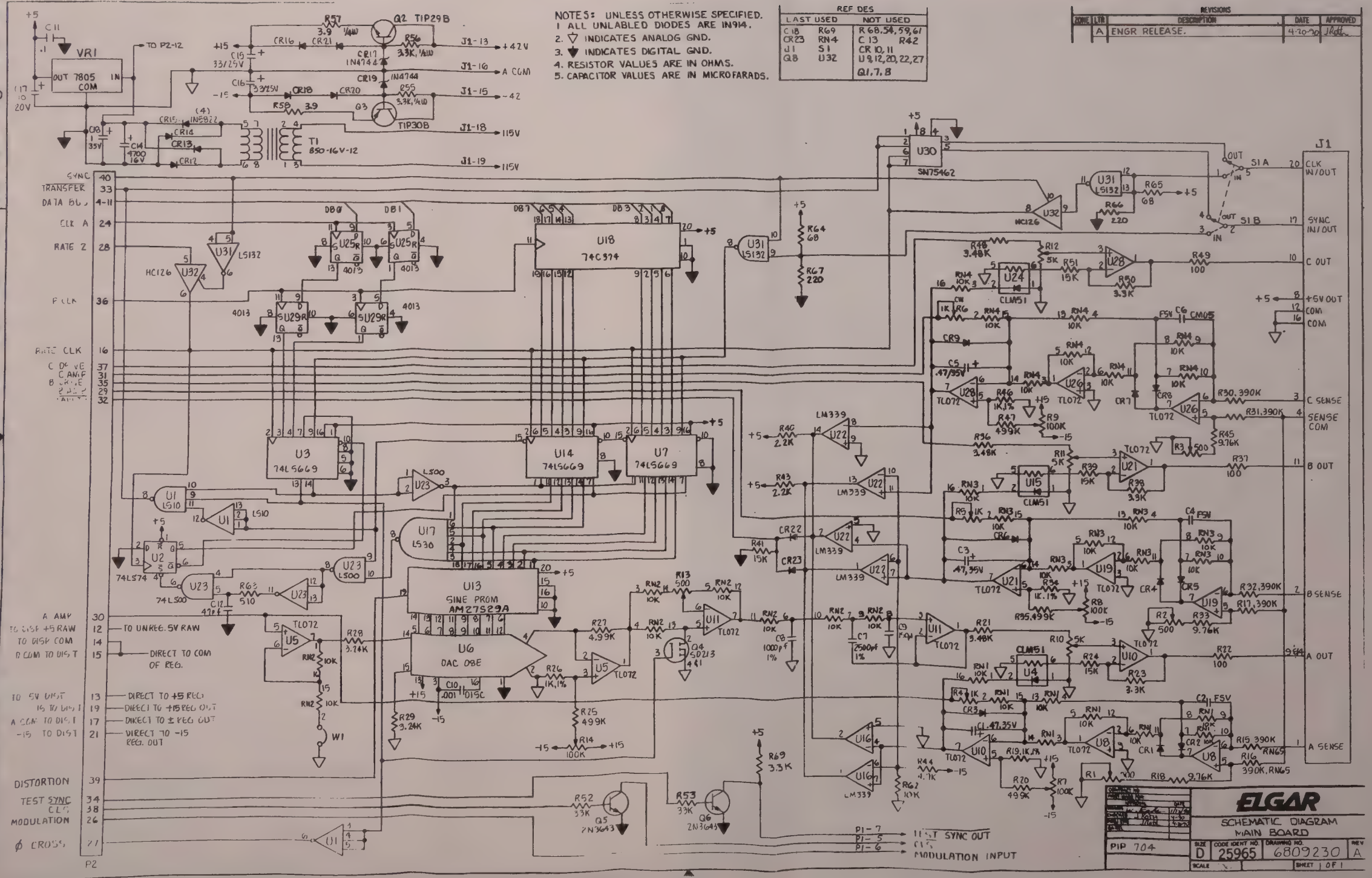
ELGAR

PHASE BD. SCHEMATIC

PIP704

SIZE	CODE IDENT NO.	DRAWING NO.	REV
D	25965	6809231	A

SCALE | SHEET 1 OF 1


NOTES: UNLESS OTHERWISE SPECIFIED.
1 ALL UNLABLED DIODES ARE IN914.
2. ▽ INDICATES ANALOG GND.
3. ▼ INDICATES DIGITAL GND.
4. RESISTOR VALUES ARE IN OHMS.
5. CAPACITOR VALUES ARE IN MICROFARADS.
REF DES
LAST USED
NOT USED
C18 R69 R68,54,59,61
CR23 RN4 C13 R42
J1 S1 CR10, 11
Q8 U32 U9,12,20,22,27
Q1,7,8
REVISIONS
ZONE LTR DESCRIPTION DATE APPROVED
A ENGR RELEASE. 4-20-30
VR1
TO P2-12
J1-13 +42V
J1-16 A COM
J1-15 -42
J1-18 115V
J1-19 115V
T1 850-16V-12
Q2 TIP29B
Q3 TIP30B
U30 SN75462
U31 LS132
U32 HC126
U18 74C374
U25 4013
U29 4013
U3 74LS669
U14 74LS669
U7 74LS669
U13 SINE PROM AM27S29A
U6 DAC 08E
U17 LS30
U23 LS00
U1 LS10
U2 74LS74
U5 TL072
U15 CLM51
U24 CLM51
U4 CLM51
U22 LM339
U16 LM339
U21 TL072
U26 TL072
U28 TL072
U19 TL072
U11 TL072
U10 TL072
U8 TL072
Q4 SD213
Q5 2N3643
Q6 2N3643
SYNC
TRANSFER
DATA BUS
CLK A
RATE Z
P CLK
RATE CLK
A AMP
TO DIST +5 RAW
TO DIST COM
B COM TO DIST
DIRECT TO COM OF REG.
TO UNREG. 5V RAW
TO 5V DIST
15 TO DIST
A COM TO DIST
-15 TO DIST
DIRECT TO +5 REG.
DIRECT TO +15 REG OUT
DIRECT TO ± REG OUT
DIRECT TO -15 REG. OUT
DISTORTION
TEST SYNC CLK
MODULATION
Ø CROSS
P2
J1
CLK IN/OUT
SYNC IN/OUT
C OUT
+5V OUT
COM
COM
C SENSE
SENSE COM
B OUT
B SENSE
A OUT
A SENSE
S1A
S1B
P1-7 TEST SYNC OUT
P1-5 CLK
P1-6 MODULATION INPUT
ELGAR
SCHEMATIC DIAGRAM
MAIN BOARD
PIP 704
SIZE D
CODE IDENT NO. 25965
DRAWING NO. 6809230
REV A
SHEET 1 OF 1

PIP 9823 Manual

M869200-01 ELGAR CORPORATION PRINTED IN U.S.A.

ELGAR *Limited Warranty*

Elgar Corporation warrants its products to be free from defects in material and workmanship. This warranty is effective for one year from the date of shipment of the product to the original purchaser. Liability of Elgar under this warranty shall exist provided that:

the Buyer exposes the product to normal use and service, and provides normal maintenance on the product,

Elgar is promptly notified of defects by the Buyer and that notification occurs within the warranty period,

buyer receives a Return Material Authorization (RMA) from Elgar prior to the return of the product to Elgar for repair,

buyer returns the defective product in the original, or equivalent, shipping container,

examination of such product by Elgar discloses that in fact a defect in materials and/or workmanship does exist,

the defects in the product were not caused by improper conditions, misuse or negligence; and

Elgar markings and nameplates have not been altered or removed and the equipment has not been repaired or modified by other than Elgar authorized personnel.

This warranty is exclusive and in lieu of all other warranties, expressed or implied, including, but not limited to, implied warranties of merchantability and fitness of the product to a particular purpose. Elgar Corporation, its agents, or representatives, shall in no circumstance be liable for any direct, indirect, special, penal, or consequential loss or damage of any nature resulting from the malfunction of the product. Remedies under this warranty are expressly limited to repair or replacement of the product.

CONDITIONS OF WARRANTY

- To return a defective product, contact an Elgar representative or the Elgar factory for an RMA. Unauthorized returns will not be accepted and will be returned at the shipper's expense.
- For Elgar product found to be defective within thirty days of receipt by the original purchaser, Elgar will absorb all ground freight charges for the repair. Product found to be defective within the warranty period, but beyond the initial thirty day period, should be returned prepaid to Elgar for repair.
- Normal warranty service is performed by Elgar during the weekday hours of 8 AM to 5 PM Pacific Time. Warranty repair work requested to be accomplished outside of normal working hours will be subject to ELGAR nonwarranty service rates.
- Warranty field service is available on an emergency basis. Travel expenses (travel time, per diem expense, and related air fare) are the responsibility of the customer. A customer purchase order is required by Elgar prior to scheduling.
- Product found, upon inspection by Elgar, to be in specification is subject to an inspection fee and applicable freight charges.
- Equipment purchased in the United States carries only a United States warranty for which repair must be accomplished at the Elgar factory.

ELGAR Corporation
9250 Brown Deer Road, San Diego, California 92121
619/450-0085 ■ 800/73-ELGAR
FAX 619/458-0267 ■ TELEX 211063 ELSD UR

TABLE OF CONTENTS

SECTION 1
DESCRIPTION

1-1 Introduction. 1-1
1-3 General Description 1-1
1-5 Physical Description. 1-1

SECTION 2
INSTALLATION

2-1 General 2-1
2-3 Preinstallation Inspection. 2-1
2-5 Electrical Connections. 2-1
2-7 IEEE-488 Interface Connections. 2-2

SECTION 3
OPERATION

3-1 Introduction. 3-1
3-2 Controls and Indicators 3-1
3-3 IEEE-488-1978 Programming 3-2
3-4 Adress Switch 3-2
3-5 ABLE Language Syntax. 3-2
3-6 DAP Language Syntax 3-4

SECTION 4
THEORY OF OPERATION

4-1 Introduction. 4-1
4-2 Overall Theory of Operation 4-1
4-3 Detailed Circuit Description. 4-1

SECTION 5
MAINTENANCE

5-1 General 5-1
5-2 Test Equipment Required 5-1
5-3 Disassembly 5-1
5-4 Calibration Adjustments 5-2

TABLE OF CONTENTS (Cont'd)

SECTION 6
PARTS LISTS

6-1 General 6-1
6-3 Spare Parts Ordering. 6-1
6-5 Parts Lists 6-1

SECTION 7
DIAGRAMS

7-1 General 7-1
7-3 Diagrams. 7-1

LIST OF TABLES

1-1 Performance Specifications 1-2
2-1 J1 Connections. 2-2
2-2 Jumper Settings 2-2
5-1 Test Equipment Required 5-1

****
* WARNING! *
****

High voltages dangerous to life exist when operating this unit with a Power Source system. Program voltages to zero before connecting or disconnecting output voltage sense leads. Exercise extreme caution when performing maintenance checks in the unit. Always remove power when disconnecting circuit boards, performing continuity checks or disassembling the unit.

SECTION 1
DESCRIPTION

1-1. INTRODUCTION

1-2. This instruction manual has been prepared for use with the Elgar Model 9023 Plug In Programmer. The instructions it contains are intended for use by operators and maintenance technicians with regard to the installation, operation, adjustment, troubleshooting, and repair of the Plug In Programmer. The theory of operation, description, parts list, and schematics are included to aid in maintaining the Model 9023 at optimum performance.

1-3. GENERAL DESCRIPTION

1-4. The Elgar Series 9023 Plug In Programmer (PIP) is a solid state instrument intended for use in Automatic Test Equipment (ATE) systems. In response to digitally coded command inputs from a system controller, the PIP produces output signals which are, in turn, inputs to an AC Power Source. The Series 9023 programs the frequency and the independent amplitudes and phase angles of a three phase AC Power Source. It also has a built in measurement system that is capable of measuring the output voltage, load current, load watts, frequency and phase angle of its associated AC Power Source.

1-5. PHYSICAL DESCRIPTION

1-6. The Series 9023 PIP is configured to fit the standard oscillator cavity of all Elgar AC Power Sources. It is not intended to be used with the Elgar 'C' Series of AC Power Sources due to isolation problems.

TABLE 1-1 PERFORMANCE SPECIFICATIONS

GENERAL

INPUT POWER:	117 VAC, +42 VDC, and -42 VDC from associated AC Power Source
OUTPUT SIGNAL:	0 to 2.5 VAC into an 800 ohm load (per phase)
OPERATING TEMP RANGE:	0 degrees C to +50 degrees C
PROGRAMMING:	Local or GPIB per IEEE-488-1978
DISTORTION (THD):	Less than 1% within power source range

FREQUENCY PROGRAMMING

FREQUENCY RANGES: (Autorange)	45 Hz to 999.9 Hz in 0.1 Hz steps 1000 Hz to 5000 Hz in 1 Hz steps
FREQUENCY ACCURACY:	0.001% of set value
FREQUENCY TEMCO:	0.003% per degree C average (0-50 degrees C)
FREQ SETTLING TIME:	1/2 Cycle or less at new frequency

AMPLITUDE PROGRAMMING

VOLTAGE RANGES: (RANGE PROGRAMMABLE)	0 to 67.5 VAC in 0.1 VAC steps 0 to 135 VAC in 0.1 VAC steps 0 to 270 VAC in 0.1 VAC steps
VOLTAGE ACCURACY:	+/- 0.15% of F.S. 45 Hz to 2000 Hz from 5% of F.S. to F.S. Increases 0.015% per 1 KHz above 2 KHz
AMPLITUDE TEMCO:	+/- 0.01% per degree C average (0-50 deg C)
AMPLITUDE LINE REG:	+/- 0.01% for a 10% line change within line operating range
AMPLITUDE LOAD REG:	+/- 0.01% full wave average at point of sense
AMPLITUDE SETTLING:	Less than 50mS when programming from above 5% of F.S.

TABLE 1-1 PERFORMANCE SPECIFICATIONS (Cont'd)

PHASE ANGLE PROGRAMMING

PHASE ANG RESOLUTION:	0 to 399 degrees in 0.5 degree steps
PHASE ANGLE ACCURACY:	+/- 1 degree from 45 Hz to 2000 Hz

CURRENT LIMIT PROGRAMMING

RANGE:	5% to 100%
RESOLUTION:	0.01 Ampere
ACCURACY:	+/- 1% F.S. +/- 5% RDG
CREST FACTOR:	3.5 to 1 minimum
CURRENT TEMCO:	+/- 0.02% F.S. +/- 0.01 RDG pre degree C avg

MEASUREMENT SYSTEM SPECIFICATIONS

VOLTAGE

RESOLUTION:	0.1 VRMS from 0 to 300 VRMS
ACCURACY:	+/- 0.1% F.S. +/- 0.05% RDG
TEMCO:	+/- 0.01% F.S. +/- 0.01 RDG per degree C avg

CURRENT

RESOLUTION:	0.01 Ampere
ACCURACY:	+/- 1% F.S. +/-0.5% RDG
CREST FACTOR:	3.5 to 1 minimum
TEMCO:	+/- 0.02 F.S. +/- 0.01% RDG pre degree C avg

TABLE 1-1 PERFORMANCE SPECIFICATIONS (Cont'd)

MEASUREMENT SYSTEM SPECIFICATIONS (Cont'd)

POWER

RANGES:	500W, 1KW, 2KW, and 4KW
RESOLUTION:	1 Watt
ACCURACY:	+/- 1% F.S. +/- 0.5% RDG
TEMCO:	+/- 0.01% F.S. +/- 0.02 RDG per degree C avg

FREQUENCY

RANGE:	0 tp 5000 Hz
RESOLUTION:	1 Hz
ACCURACY:	+/- 1 Digit (1 Hz)
TEMCO:	+/- 1 Digit 0 to 50 degrees C

SPECIFICATIONS NOT NECESSARILY APPLICABLE TO MATE (CIIL) UNITS.

SECTION 2
INSTALLATION

2-1. GENERAL

2-2. This section of the manual contains instructions for pre-installation inspection and electrical connections.

2-3. PREINSTALLATION INSPECTION

2-4. The AC Power Source has been packed in accordance with industrial standards for safe shipment. Upon receipt of the unit, unpack and inspect the unit as described in the following steps.

1. Make a visual inspection of the shipping container before accepting the package from the carrier. If the shipping container is damaged, describe the damage on the carrier receipt.

2. If there is no apparent damage to the shipping container, carefully unpack the instrument and save the container and filler materials until preliminary inspection is completed.

3. Remove the PIP from oscillator cavity and inspect for damage.

4. Inspect rear of associated AC Power Source for damage to connectors.

2-5. ELECTRICAL CONNECTIONS (See Table 2-1)

2-6. The following steps must be performed prior to operation to ensure proper operation.

1. If a multi-unit system, connect output drives to other power sources J1 pin 4 with J1 pin 1 as common. (See Table 2-1)

2. Connect sense leads and sense common to load.

WARNING! CAUTION!

DO NOT OPERATE PIP WITH SENSE LEADS DISCONNECTED WHILE A LOAD IS WIRED TO THE ASSOCIATED AC POWER SOURCE AS THE OUTPUT VOLTAGE WILL BE 10% HIGHER THAN PROGRAMMED AND MAY DAMAGE LOAD!

2-7. IEEE-488 INTERFACE CONNECTIONS

2-8. Simply connect the GPIB cable to the 24 pin IEEE-488 connector on the associated AC Power Source.

TABLE 2-2 J1 CONNECTIONS ON REAR OF ASSOCIATED AC POWER SOURCE

PIN 1	OUTPUT DRIVE COMMON
PIN 2	B PHASE OUTPUT DRIVE
PIN 3	C PHASE OUTPUT DRIVE
PIN 4	A PHASE OUTPUT DRIVE
PIN 5	+5VDC (50mA maximum)
PIN 6	RELAY DRIVE 1 (270 V RNG)
PIN 7	RELAY DRIVE 2 (67.5 V RNG)
PIN 8	DISCONNECT RELAY DRIVE
PIN 9	SENSE COMMON
PIN 10	C PHASE SENSE
PIN 11	B PHASE SENSE
PIN 12	A PHASE SENSE

TABLE 2-2 JUMPER SETTINGS

There are only two jumpers in the series 9023 PIP. These are located on the Microprocessor Board Assembly.

W1 JUMPER	W2 JUMPER	POWER RANGE OF TEST BOARD
OPEN	OPEN	500 WATTS
OPEN	CLOSE	1000 WATTS
CLOSE	OPEN	2000 WATTS
CLOSE	CLOSE	4000 WATTS

OPERATION

3.1 INTRODUCTION

This section contains information regarding the preliminary functional checkout of the Series 9023 PIP, a description of the front panel controls and remote programming information.

3.1.1 Initilazation Conditions

The power on defaults are:

1.	Frequency	400.0 Hz
2.	Amplitudes	All phases to zero volts
3.	Current Limit	0000 (This inhibits CURL until a value set.
4.	Phase Angle A	0 degrees (Phase A only programmed in SYNC)
5.	Phase Angle B	240.0 degrees
6.	Phase Angle C	120.0 degrees
7.	SYNC	Off
8.	Disconnect Relay	Open
9.	Local/Remote	Local
10.	GPIB Language	ABLE

The GPIB SDC or DCL defaults are the same except that 9 and 10 are not defaulted and remain as programmed.

3.2 CONTROLS AND INDICATORS.

LOCAL OPERATION

The front panel has a 4-digit display, 9 LED enunciators and a 16 key keypad. Five of the keys have a second function which is accessed by first pressing the YELLOW "2nd" key. Keys 1, 2, 3 & 5 have letters a, b, c and abc on them. This is for Phase selection.

The basic entry sequence is: Select function, Select phase, Enter Value and press ENT key.

Example: Press V, a, 115.5, ENT. This would program a Phase Amplitude to 115.5 Volts.

Example: Press I, abc, 2.34, ENT. This would program all phases to a current limit of 2.34 Amperes.

Example: Press 2nd, F, 1234, ENT. This would program frequency to 1234 Hz. Frequency does not require a phase selection.

The basic RTN (return previously programmed information) sequence is much the same as the entry sequence. Select Function, Phase (abc will not RTN) and press RTN.

Example: V, c, RTN. This will recall the last programmed value of C phase.

Example: 2nd, P<, b, RTN. This will return the last value programmed into C phase angle.

TO AQUIRE INFORMATION FROM THE TEST BOARD.

The operating sequence is very similar to RTN function except that it is now select Function, select phase, 2nd, TST.

Example: V, b, 2nd, TST. This will call up the voltage measurement of B phase. All measurements will continue until a Key is pressed or the PIP is taken into Remote.

NOTE: For Frequency or Phase Angle Measurements, The measured Phases must be programmed to over 15 volts or an ERROR code will be displayed. (This also applies to remote operation!)

to program a range change from local Press 2nd and then:

1 to the 67.5V range
2 to go to the 135V range
3 to go to the 270V range

LOCAL DISCONNECT RELAY OPERATION

To operate the output relay from local, press 2nd RLY. This is a toggle operation and thus changes state each time 2nd,RLY is sent.

3.3 IEEE-488-1978 PROGRAMMING

The 9023 PIP Implements the following subsets of the IEEE 488 interface specification.

SOURCE HANDSHAKE	SH1
ACCEPTOR HANDSHAKE	AH1
TALKER	T6
LISTENER	L4
SERVICE REQUEST	SR1
REMOTE LOCAL	RL1
PARALLEL POLL	PP0
DEVICE CLEAR	DC1
DEVICE TRIGGER	DT0
CONTROLLER	C0

3.4 ADDRESS SWITCH

The Listen and Talk Addresses to which the PIP will respond are determine by the setting of the Address Switch. This switch is located on the Processo Board. The Processor Board is the second board down and the switch is locate on the left side of the board where it can be accessed without removing the Test Board. To access the Address Switch, slide the PIP partially out of the cavity, set switch, and return PIP to cavity. The Address Switch is normally set on address 17 (DECIMAL) when the unit is shipped. That is, with S1 and S5 on and the others off. The switch is Binary coded so S1 is a 1 weight and S5 a 16 weight so the result is 17 in Decimal. Addresses 0 through 30 are valid addresses. Address 31 is not a valid address as this is used for UNL (Unlist by the IEEE-488 Convention.

3.5 ABLE LANGUAGE SYNTAX:

VOLTA	Prefix for A phase voltage. Followed by number (In fixed or floati point decimal)
VOLTB	Prefix for B phase voltage. Followed by number.
VOLTC	Prefix for C phase voltage. Followed by number.
VOLTS	Prefix for simultaneous voltage to all phases. Followed by number.
CURLA	Prefix for current limit for A phase. Followed by number.
CURLB	Prefix for current limit for B phase. Followed by number.
CURLC	Prefix for current limit for C phase. Followed by number.
CURLS	Prefix for simultaneous current limit. Followed by number.

PANGB Prefix for phase angle program for B phase.

PANGC Prefix for phase angle program for C phase.

FREQ Prefix for frequency program.

SYNC Prefix for Synchronization. followed by 1 to set SYNC or 0 to CLR SYNC.

LOCK Causes lockout of Servo Test Functions Open Servo and Overvoltage.

UNLK Enables Servo Test Functions.

CLS Causes closure of Disconnect Relay.

OPN Opens Disconnect Relay

RNG Prefix for Amplitude Range. Followed by 0 for 67.5V Rng, 1 for 135V Rng and 2 for 270V Rng.

GAL Go Alternate Language. Go to DAP type language. (Many features do not work in DAP language). NOTE: GAL Must be sent STAND-ALONE and not as part of a Message String.

TST Measure indicated function, prep message and set SRQ 79 (Dec) if Talk Address not yet received. If talk address sent before the measurement cycle is completed then does not set SRQ.

NOTE: The TST XX Message MUST be sent STAND-ALONE and Not part of a Message String.

Test Msg	Function Measured	Return Msg Format
TST VA	Voltage A Phase	VA=xxx.x0
TST VB	Voltage B Phase	VB=xxx.x0
TST VC	Voltage C Phase	VC=xxx.x0
TST IA	Current A Phase	IA=xx.xx0
TST IB	Current B Phase	IB=xx.xx0
TST IC	Current C Phase	IC=xx.xx0
TST WA	Wattage A Phase	WA=xxxx.0
TST WB	Wattage B Phase	WB=xxxx.0
TST WC	Wattage C Phase	WC=xxxx.0
TST PB	Phase Angle B Phase	PB=xxx.x0
TST PC	Phase Angle C Phase	PC=xxx.x0
TST FR	Frequency	FR=xxxx.0

(NOTE: x=Number 0 to 9)

3.5.1 ABLE MESSAGE FORMATING

The ABLE language format allows the message to contain several functions to be programmed in the same message string. All parts of the message string will be parsed and checked prior to entering any part of the message. There no set sequence or priority of functions in the message string. Exceptions the stringing are: SYNC, TST XX and GAL. Message Separator is a Comma (,) an message terminator is (cr)(lf).

Example: "VOLTA 110,VOLTB 115,VOLTC .12E+3,CURLS 3.33,CLS"(cr)(lf).
This would set phase A to 110V, phase B to 115V, phase C to 120V, Current Limit to 3.33 Amperes on all phases and close the Disconnect Relay. Please note that there are no spaces after the commas But tha There is a space following a Prefix.

NOTE: If there is an Error anywhere in the Message String, NO part of the message will be entered and the appropriate SRQ Status byte will be sent.

3.5.2 SRQ STATUS BYTES

Status Byte	Meaning of Status Byte	Other Effects
64	Servo Error	Will shut down Power Source
67	Overvoltage Error	Will shut down Power Source
71	Current Limit A Phase	Will shut down Power Source
72	Current Limit B Phase	Will shut down Power Source
73	Current Limit C Phase	Will shut down Power Source
74	Syntax Error	
75	Command Error	
76	Input Buffer Overflow	
78	Test Board Overloaded	
79	Test Board Data Available	

3.6 DAP LANGUAGE SYNTAX

IN the DAP Language the PIP only recognizes numbers 0 to 9 and Letters A, B, C, D, E, F, G, H, L AND R. Any other ASCII character will be ignored.

The entry sequence will be: Enter four numbers (the decimal is not sent it would be ingored) and then a letter. The letter, when sent, executes the function. No (cr)(lf) need be sent, but if sent it will be ignored.

The ignored characters will get a normal Handshake but are not further recognized.

MEANING OF LETTERS

Letter	Meaning
A	A Phase Voltage
B	B Phase Voltage
C	C Phase Voltage
D	B Phase Angle
E	Simultaneous Voltage to All Phases
F	Frequency
G	C Phase Angle
H	Voltage range. 0000H=135V Rng, 4000H=270V Rng and 6000H=67.5V Rng
L	Go Alternate Language. Go to ABLE Language.
R	Disconnect Relay. 0000R= Open and 0001R= Close.

Example: '1100E' Would set all Phases to 110.0 Volts.

Example: '1105A1150B1205C0400F0001R' This would set A Phase to 110.5 Volts, B Phase to 115.0 Volts, C Phase to 120.5 Volts, Frequency to 400 Hz and close the disconnect relays.

NOTE: The string messages are position dependent in the DAP language. That is because the letter, when received, executes that function at that time, prior to receiving the ne t part of the message. In the above example, that is why the 0001R is sent last. This allowed the unit to be programmed prior to closing the Disconnect Relay.

The DAP Language does not allow service requests nor does it check entered values.

SECTION IV
THEORY OF OPERATION

4.1 INTRODUCTION

This section contains an overall description of the Series 9023 PIP as well as the description of each major circuit. This section should be read prior to attempting to troubleshoot or perform any maintenance of the equipment.

4.2 OVERALL THEORY OF OPERATION

When power is applied, the microprocessor sets the inital conditions to all storage registers. These conditions are frequency to 400.0 Hz, amplitude to zero on all phases, phase angle A to zero, phase angle B to 240 degrees, phase angle C to 120 degrees, SYNC to off, amplitude range to 130 V, current limits to zero (lockout condition) and disconnect relay open. These are the same conditions set by the GPIB commands SDC or DCL.

The processor board has a 7.2 MHz crystal clock which will be converted to the Rate Clock by the Rate Multipliers. The Rate Clock is 720 times the output frequency. This will be further counted down by the phase up/down counters to the output frequency thus giving 180 bits per quarter wave for frequency synthesis. This is conditioned and filtered and becomes the output drive to the associated power source.

The amplitude data is converted to 12 bit binary and stored in digital to analog converters which program servo controls of the output amplitude.

The phase angle data is converted to binary angle and quadrant information which digitally controls the appropriate phase angle.

The SYNC command causes the Slave unit to use the Rate Clock and a sync signal from the Master unit thus making it a slave in frequency and A phase angle to the A phase of the master unit. The A phase of the slave unit may then be programmed zero to 360 degrees in reference to the master unit.

4.3 DETAILED CIRCUIT DESCRIPTION

In the following paragraphs, those circuits which make the 9023 PIP possible are described in detail. In preparing this text it has been assumed that the reader is familiar with analog and digital devices such as digital to analog converters, operational amplifiers, logic gates, RAMS, PROMS, counters and other commonly used devices. Therefore, the internal circuitry of these devices is not described in this manual. The reader is referred to the manufactors publications for this information.

4.3.1 PROCESSOR BOARD LOGIC

The heart of the 9023 PIP is the microprocessor U6. This is an 8-Bit processor with 2 8-Bit input/output ports. PORT A (PA0 to PA7) is used as an input port when taking data from the keyboard or the Test Board and as an output port when writing to the Display, Phase board, Test board or A phase angle. PORT B is used as a control port where some of the bits are inputs (PB0, PB1, PB2 and PB5) and the remainder are outputs.

The memory map decoder is U1 while U13 is a decoder for data storage strobes.

As the microprocessor data bus is multiplexed with the lower 8 bits of the address bus, U5 is required to store the lower 8 bits of the address bus.

The main program memory is located in EPROM U2 and EPROM U3 and the static RAM is U4.

The GPIB transfers are handled by U27, U29 and U30. The GPIB "smart" chip is U27 while U29 and U30 are the bus transceivers. The address switch is read VIA U24 and the address is stored in U27. Jumpers W1 and W2 set the scaling for the Test Board readout.

The most significant 8 bits of the BCD frequency are stored in U10 until the least significant 8 bits are sent, at which time all 16 bits are stored in U9 and U16. When sending amplitude, the most significant 4 bits are saved in

U10 until the least significant 8 bits are sent to the appropriate amplitude DAC (Digital to Analog Converter). The DACs are U17 (A Phase), U18 (B Phase) and U19 (C Phase). These are 12 bit Binary DACs used to program amplitude.

The Rate Multipliers U8 (MSB), U7, U15 and U14 (LSB) take the output of oscillator/buffer U23 and convert it to a pulse train that is 7200 times the output frequency. BCD counter U27 will count the pulse train down by 10 when in the 999.9 Hz range but is bypassed in the 5 KHz range. By either route, the output at U6 pin 6 is 720 times the output frequency. This is the RATE2 output to the main board.

Extra output Ports for Range drives, Disconnect Relay drive and several enables are brought out Via latch U20.

4.3.2 DISPLAY BOARD LOGIC

The display driver U1 is a 1 of 8 multiplexed driver. It has an addressable input which is controlled by DA0, DA1 and DA2. The BCD information is on D0 to D3. The decimal point is entered on Dec Pt and is low true where addresses and BCD information are high true. If for example, DS4 (the LSB digit) is to show a 5 with the decimal lit, then DA0,1 & 2 would be low, (the address of DS4) D0 & D2 would be high, (setting a BCD 5) and D1, D3 and Dec Pt would be low at write pulse time. Each of the other three digits would be entered in a similar manner and once entered would remain the same until updated.

DS5 through DS13 are LED enunciators and are driven by segments and decimal point drivers for the other 4 digit drivers. Remember this is a 1 of 8 driver and there are only 4 display digits.

When a button on the Keypad is pressed, it will cause a row and a column output to go high. This will cause U3 to generate a strobe which will store the row and column information in U2. The same strobe will clock U4 to the set condition. This will signal the microprocessor that a keypad byte is available. When the processor reads the byte from U2 it will also reset Byte Waiting F/F U4.

4.3.3 MAIN BOARD LOGIC

The RATE2 clock, generated on the Processor board comes in on J1 pin 28 and is applied to the up/down counter composed of U2, U3, U7, U14, U18 and U23. This counter counts up to 179, holds 179 for an extra count, then counts down to zero. It will hold zero for an extra count and then count up. This counting logic is used to reduce harmonic distortion. U3 counts the phase quadrants and U18 pin 3 controls the up/down action.

The output of the up/down counter is applied to U13 which is a PROM with a sine look-up table. U13 in turn drives the digital inputs to to DAC U6. The multipling DAC will put out a current that is proportional to the analog input applied to R28 and the instantaneous digital signal applied. The current output of the DAC is converted to a voltage by U5 pins 1, 2 and 3. The voltage at U5 pin 1 is a series of half wave signals of which half will be inverted by U11 pins 5, 6 and 7. U11 pins 5, 6 and 7 is an invert/noninvert circuit which is noninverting until Q4 is turned on, at which time it becomes an inverting amplifier. U3, which counted the quadrants of the sine-wave, controls Q4 so that in quadrants 2 and 3 (180 to 360 degrees) the circuit is inverting.

The output of the invert/noninvert circuit is fed to an active filter which has its output at U11 pin 1. The output of the active filter is fed to variable gain amplifier U10 pins 1, 2 and 3. The variable gain amplifier is controlled by the amplitude servo.

The programming voltage, generated on the processor board, is applied to the A phase error integrator U10 pins 5, 6 and 7 through R4 and U9 pins 2 to 15. This causes pin 7 of U10 to go to the negative stop which in turn drives U4 photo diode to maximum on. When U4 diode is on maximum, the restance of U4 photoresistor is minimum. This causes the variable gain circuit to have maximum gain. This is the "Open Servo" condition.

When the servo feedback is closed, an AC voltage is applied to R15 and R16. The AC signal is rectified by CR1 and CR2 and applied to the error integrator summing junction U10 pin 6. This causes U10 pin 7 to move in a less negative direction reducing the gain of the variable gain amplifier.

The B phase and C phase servo systems operate in the same manner as that of the A phase servo.

Syncronization for the B and C phase angle programming is a pulse generated at U1 pin 8. This is the NAND of Quadrant 3 and zero count in the up/down counter. This is the "Transfer" signal which is also used for external sync.

When operating in external SYNC, U18, U25 and U29 allow the A phase to be programmed in reference to the incoming Sync signal. This allows the Slave phases to be rotated in reference to the Master unit A phase. When in SYNC, the RATE2 clock is disconnected and the RATE2 from the Master unit to be used. This makes the Slave unit follow the frequency of the Master unit. Switch S1 controls the master/Slave status of the oscillator.

U16 and U22 detect open servo conditions or overvoltage conditions. An overvoltage condition is where the output voltage exceeds the programmed value.

The A phase voltage ranging is controlled by the gain of U5 pins 5,6 and 7. The programming voltage is applied to pin 5 of U5 and in the 130 V range the amplifier has a gain of 2 (Q1 on). In the 65 v range, Q8 is also turned on giving a gain of 4. In the 260 V range both transistors are off giving a gain of 1. The same signals that control the gain also go to Q6 and Q7 which control the range relays in the associated power source.

4.3.4 PHASE BOARD LOGIC

As the operation of the up/down counters and other sine generation circuits is the same as that of the A phase, it will not be repeated here.

The Binary phase angle information is received in two bytes. The first byte is two bits of quadrant information and is temporarily saved in latch U7 by CLKA. Then when the 8 bit byte is on the data bus, the CLKB or the CLKC is sent. This stores the 8 bit byte plus the quadrant two bits from U7 to be stored in the B or C phase holding latches (U5/U6 for B phase and U18/U19 for C phase).

The "Transfer" signal from the main board causes the preset inputs of the 74LS669 counters to accept the stored data (Angle) at the next clock time. U13 inhibits the transfer signal during register loading to prevent a race condition.

4.3.5 TEST BOARD LOGIC

The Test sequence is iniated by the SET pulse latching Data bus information into U7. The two LSB bits out of U7 are on pins 12 and 2. These control the phase selection. The next two bits control the input to the A to D converter for Volts, Current or Watts. Pin 19 when high enables the frequency counter or the phase angle measurement. Pin 9 when high enables frequency measurement and when low enables phase angle measurement. The SET pulse also sets U15 pin 9 to the BUSY state. When the measurement is complete, U15 pin 9 will be set low to indicate that data is available.

When measuring Volts or Current the analog signals are routed through TRMS converter U29 to the active filter U17 pins 1, 2 and 3. When measuring Watts the instantaneous voltage and current are multiplied by U26 and routed to the active filter.

After a period to allow proper settling time in the active filter, U11 will start the A to D converter U3. Approximately 100 us later the BUSY signal will be set false indicating data is available.

When measuring frequency, U18, U19 and the crystal oscillator will generate a one second time base. The number of times the A phase zero crosses during this period is the frequency. U12 pin 9 will go low and through U9 this will shut down counters U1 and U4 and store the result in U2 and U5 for later access

by the microprocessor. The same signal clocks U15 ending the BUSY signal.

In measuring phase angle, the B or C comparators start a gate that is end by the A phase comparator. During this gate period, the counters U1 and U4 ar counting the number of RATE clock pulses. As there are two rate clock pulses per degree, the phase angle can be determined to one half degree by the numbe of Rate clocks counted.

Pin 19 of U7 also determines the source for output data to the processor. When Output Enable goes true (High) and U7 pin 19 is high the A to D output will be accessed. Conversly if pin 19 of U7 is low then U2 and U5 latches wil be accessed.

Pin 15 of U7 is used to control K1. This relay is used for special purpos applications such as MATE systems. K1 is a FORM B relay That is normally on. (on is open contacts in a FORM B). If fault occurs or if power fails, the rel contacts will close.

MAINTENANCE

5.1 GENERAL

This section of the manual contains proceedures for verification of performance, disassembly, troubleshooting and calibration of the Series 9023 PIP. The PIP is delivered with all adjustments and calibrations completed. Further adjustment should not be required unless a malfunction occurs and certain critical parts are replaced.

If the proceedures of this section and the circuit descriptions of Section IV do not provide sufficient information to locate and correct a malfunction, the assistance of the Elgar Service Department should be requested. Equipment should not be returned to the Elgar factory without the express authorization of Elgar Corporation or its appointed representitive. Elgar cannot assume the responsibility for equipment returned without authorization.

5.2 REQUIRED TEST EQUIPMENT

The equipment required to conduct the performance verfication proceedures and for troubleshooting is listed in Table 5-1. Substitute equipment may be employed provided it meets the accuracy specifications of the listed equipment.

5.3 DISASSEMBLY

The boards of the PIP 9023 may be accessed for calibration or maintenance by using following steps.

1. The Test Board adjustments are all acessable by removing the Power Source top cover.
2. The only ajustment on the Processor Board is the frequency trimmer capacitor which is acessable on the left side of the board.
3. To acess the adjustments of the Phase Board or the Main Board, back off the two screws which are acessable through two large holes at the rear corners of the Test Board. (Do not remove screws). Then hinge up the rear of the Test/Processor Boards to acess the Phase Board. The Phase Board may be then hinged up to provide access to the Main Board.
4. The same methods are used to access for troubleshooting. If access is required to troubleshoot the Processor Board, remove its three hold down screws and remove the Test Board.

TABLE 5-1. REQUIRED TEST EQUIPMENT

Differential AC Voltmeter	Fluke Model 931B or equal
Frequency Counter	H.P. Model 5315A or equal
Digital Multimeter	Fluke Model 8050A or equal
Oscilloscope	Tektronix Model 455 or equal
Distortion Analyzer	Krohn-Hite Model 6800 or equal
Phase Angle Meter	Krohn-Hite Model 6400 or equal
Ammeter/Wattmeter	Valhalla Model 2101 or equal

5.4 CALIBRATION ADJUSTMENTS

All adjustments are made at the factory and shoud not require recalibrat unless a component has been replaced or the power Source and Oscillator has been exposed to severe vibration/shoch.

If the 9023 PIP is moved from one Elgar Power Source to another of the s model, no recalibration is required. If it moved to a different model the OP servo adjustment is required to match it to the gain of the new source.

NOTE ! ALL CALIBRATION IS DONE IN LOCAL CONTROL.

5.4.1 RECALIBRATION (Normally all that is needed if no components have been replaced. (Go to 5.4.2 if complete calibration required).

1. Program all outputs to 100.0 volts at 800 Hz and close disconnect relay, if installed.
2. Monitor A phase output with DMM on 100 Volt Range.
3. Adjust Main Board R4 (A F.S.) for 100 VRMS out +/- 0.05 VRMS.
4. Move DMM to Phase B output.
5. Adjust Main Board R5 (B F.S.) for 100 VRMS out +/- 0.05 VRMS.
6. Move DMM to Phase C output.
7. Adjust Main Board R6 (C F.S.) for 100 VRMS out +/- 0.05 VRMS.
8. Program all Phases to 10.0 volts (still at 800 Hz).
9. Adjust Main Board R9 (C ZERO) for 10 VRMS out +/- 0.05 VRMS.
10. Move DMM to Phase B output.
11. Adjust Main Board R8 (B ZERO) for 10 VRMS out +/- 0.05 VRMS.
12. Move DMM to Phase A output.
13. Adjust Main Board R7 (A ZERO) for 10 VRMS out +/- 0.05 VRMS.
14. Go back and do steps 1 through 13 as required to compensate for inter action of adjustments.
15. END of short calibration.

5.4.2 Frequency Calibration

1. Key in 2000 Hz and 100 volts on all phases. Close Disconnect Relay, i installed.
2. Monitor A Phase output with Frequency Meter and adjust C19 on the processor Board for 2000 Hz +/- 0.02 Hz on the Frequency Meter.

5.4.3 Open Servo Adjustments

1. Key in 100.0 Volts to all phases at 800 Hz. Close Disconnect Relay, i

installed.
2. Monitor the A Phase output with a DMM on the 100 Volt range. Open all Servo feedback leads.
3. Adjust Main Board R10 (A OPEN) for 110.0 VRMS +/- 0.25 VRMS on output.
4. Move DMM to B Phase output.
5. Adjust Main Board R11 (B OPEN) for 110.0 VRMS +/- 0.25 VRMS on output.
6. Move DMM to C Phase output.
7. Adjust Main Board R12 (C OPEN) for 110.0 VRMS +/- 0.25 VRMS on output.
8. End of Open Servo adjustment. Close Servo feedback leads opened in step 2 above.

5.4.4 Common Mode Rejection Adjustments

1. Key in 100.0 Volts at 800Hz. Monitor A Phase output with DMM.
2. Connect a cliplead from TP3 on Test Board to output common of the power source. Record reading of DMM.
3. Move cliplead to A Phase output and adjust Main Board R1 (CMR A) until DMM reading is the same as recorded in previous step.
4. Move DMM to B Phase output.
5. Move cliplead back to output common. Record DMM reading.
6. Move cliplead to B Phase output and adjust Main Board R2 (CMR B) until DMM reading is the same as recorded in previous step.
7. Move DMM to C Phase output.
8. Move cliplead back to output common. Record DMM reading.
9. Move cliplead to C Phase output and adjust Main Board R3 (CMR C) until DMM reading is the same as recorded in previous step.
10. Remove cliplead.

5.4.5 Distortion Adjustments

1. Key in 100.0 Volts at 800 Hz and monitor A phase output with the Distortion Analyzer.
2. Adjust Main Board R13 (THD HI) and R14 (THD LO) for minimum Total Harmonic Distortion (THD) on output.
3. Move Distortion Analyzer to Phase B output.
4. Adjust Phase Board R22 (THD HI) and R20 (THD LO) for minimum distortion on output.
5. Move Distortion Analyzer to Phase C output.
6. Adjust Phase Board R21 (THD HI) and R19 (THD LO) for minimum distortion on output.

5.4.6 Phase Angle Adjustments

1. Key in 100.0 Volts to all phases at 2000 Hz with B Phase Angle to 240.0 and C Phase Angle to 120.0 degrees. Close Disconnect relay, if it is installed.
2. Monitor A Phase output to B Phase output with Phase Angle Meter.
3. Adjust C16 on Phase Board until Phase Meter reads 240.0 +/- 0.2 degrees.
4. Move Phase Meter Signal lead to C Phase output. (Leave Reference lead on A Phase).
5. Adjust C17 on Phase Board until Phase Meter reads 120.0 +/- 0.2 degrees.

5.4.7 Final Oscillator Calibration

1. Go back and do Section 5.4.1 (Recalibration) to complete the basic Calibration Proceedure prior to going on to the Test Board Calibration Proceedure in 5.4.8.

5.4.8 TEST BOARD CALIBRATION (All other required calibration should be done prior to performing the following adjustments).

1. Monitor TP4 to TP3 (Common) with DMM on 10 VDC range and adjust R1 for 5.00XX volts on DMM.

2. Key in 100.0 Volts, 800 Hz with CURL at 77.00 to all phases.

3. Key in V,a,2nd,TST.

4. Monitor TP1 to TP3 (Common) with DMM on 10 VAC range.

5. Adjust R3 for 2.00XX on DMM.

6. Move DMM high lead to U24 pin 1 and adjust R11 for 1.00XX readout on DMM.

7. Adjust R10 for 100.0 on PIP readout.

8. Key in 10.0 Volts and CURL 00.00 to all phases.

9. Key in V,a,2nd,TST and adjust R9 for 10.0 on PIP readout.

10. Repeat steps 2 through 9 as required to compensate for interaction of adjustments.

11. Key in 100.0 Volts to all phases.

12. Key in V,b,2nd,TST and adjust R4 for 100.0 on PIP readout.

13. Key in V,c,2nd,TST and adjust R5 for 100.0 on PIP readout.

14. Key in 115.0 Volts with a CURL of 77.00 to all phases and apply full load to A phase output.

15. Monitor A phase output with Digital Ammeter.

16. Key in I,a,2nd,TST.

17. Monitor pin 3 of U23 with DMM on 10 VAC range. Note reading.

18. Move DMM high lead to U23 pin 1 and adjust R2 so that DMM reading is twice that noted in the previous step. Key in CURL 00.00.

19. Adjust Power Source A phase current transformer (T4A) until the PIP display indicates the same current as the Digital Ammeter.

20. Move the load and Digital Ammeter to the B phase output.

5.4.8 TEST BOARD CALIBRATION (Continued)

21. Key in I,b,2nd,TST and adjust Power Source B phase current transformer (T4B) until the PIP display indicates the same current as the Digital Ammeter.

22. Move load and Digital Ammeter to C phase output power.

23. Key in I,c,2nd,TST and adjust Power Source C phase current transformer (T4C) until the PIP display indicates the same current as the Digital Ammeter.

24. With 10% load applied to C phase output power, switch the Digital Ammeter to Wattage.

25. Key in 2nd,W,c,2nd,TST and adjust R8 until the PIP display indicates the same wattage as the Digital Wattmeter.

26. Increase the load to approximately full load.

27. Key in 2nd,W,c,2nd,TST and adjust R12 until the PIP display indicates the same wattage as the Digital Wattmeter.

28. Repeat steps 23 through 27 as required to compensation for interaction of adjustments.

29. Connect Phase Angle Meter from A phase to B phase outputs.

30. Key in 1000 Hz at 50.0 Volts to all phases and Key in 240.0 degrees to B phase and 120.0 degrees to C phase.

31. Key in 2nd,P<,b,2nd,TST and adjust R7 until the PIP display indicates the same phase angle as the Phase Angle Meter +/-0.5 degrees.

32. Move Phase Angle Meter to C phase.

33. Key in 2nd,P<,c,2nd,TST and adjust R6 until the PIP display indicates the same phase angle as the Phase Angle Meter +/-0.5 degrees.

NOTE:Steps 4,5,6,17, and 18 not needed for routine calibration.

SECTION 6
PARTS LIST

6-1. GENERAL

6-2. This section contains a listing of all parts numbers used in the manufacturing of the unit. Parts are located on the digrams in Section 7 and correlated on the parts list by using their reference designators and/or Elgar part number. Note that trimming capacitors are factory selected and their replacement is considered beyond the scope of customer maintenance.

6-3. SPARE PARTS ORDERING

6-4. When ordering spare parts, specify part name, part number, manufacturer, component value and rating. If complete assemblies are desired, contact Elgar Corporation 9250 Brown Deer Rd. San Diego, CA 92121. Specify assembly number, instrument series number and instrument name when ordering.

6-5. PARTS LISTS

6-6. Parts lists included in this section are as follows:

5809202-01	ASSY PHASE BOARD
5809204-01	ASSY PROCESSOR BOARD
5809201-01	ASSY MAIN BOARD
5809203-01	ASSY DISPLAY BOARD
5809205-01	ASSY TEST BOARD
5809200-01	ASSY FINAL 9023

5809202-01 PHASE BOARD ASSEMBLY

COLUMN #1	#2	#3	#4	#5	#6
9809202-01	--	09	ELGAR	9809202-01	PHASE BOARD
823-106-41	C1	15	SPRAGUE	196D106X0020JA1	CAP 10uf 20V
823-106-41	C2	15	SPRAGUE	196D106X0020JA1	CAP 10uf 20V
823-106-41	C3	15	SPRAGUE	196D106X0020JA1	CAP 10uf 20V
823-106-41	C4	15	SPRAGUE	196D106X0020JA1	CAP 10uf 20V
821-104-CK	C5	16	CENTRALAB	CK05BX104K	CAP .1uf 50V
820-470-05	C6	17	CORNELL DUBLIER	CM05ED470J03	CAP 47pf 500V 5%
820-470-05	C7	17	CORNELL DUBLIER	CM05ED470J03	CAP 47pf 500V 5%
821-102-00	C8	18	CENTRALAB	DDM102	CAP .001uf 1000V
821-102-00	C9	18	CENTRALAB	DDM102	CAP .001uf 1000V
820-102-01	C10	19	CORNELL DUBLIER	CM05ED102J03	CAP 1000pf 100V
820-102-01	C11	19	CORNELL DUBLIER	CM05ED102J03	CAP 1000pf 100V
820-101-05	C12	20	CORNELL DUBLIER	CM05ED102J03	CAP 100pf 500V 5%
820-101-05	C13	20	CORNELL DUBLIER	CM05ED102J03	CAP 100pf 500V 5%
828-141-15	C16	21	SPRAGUE	GZC12100	CAP VAR 14-115pf
828-141-15	C17	21	SPRAGUE	GZC12100	CAP VAR 14-115pf
820-252-01	C14	22	CORNELL DUBLIER	CD15FA252F03	CAP 2500pf 500V
820-252-01	C15	22	CORNELL DUBLIER	CD15FA252F03	CAP 2500pf 500V
835-364-3P	Q1	32	NATIONAL	PN3643	TRANSISTOR 30V
835-364-3P	Q2	32	NATIONAL	PN3643	TRANSISTOR 30V
835-364-3P	Q5	32	NATIONAL	PN3643	TRANSISTOR 30V
835-364-3P	Q6	32	NATIONAL	PN3643	TRANSISTOR 30V
842-SD2-13	Q3	33	SEMI PROCESSES	SD213DE	MOSFET 30V
842-SD2-13	Q4	33	SEMI PROCESSES	SD213DE	MOSFET 30V
801-511-05	R1	45	ALLEN BRADLEY	RC07GF511J	RES 510R .25W 5%
801-511-05	R2	45	ALLEN BRADLEY	RC07GF511J	RES 510R .25W 5%
813-324-1F	R3	46	DALE	RN60C3241F	RES 3.24KR .1W 1%
813-324-1F	R4	46	DALE	RN60C3241F	RES 3.24KR .1W 1%
813-324-1F	R14	46	DALE	RN60C3241F	RES 3.24KR .1W 1%
813-324-1F	R15	46	DALE	RN60C3241F	RES 3.24KR .1W 1%
813-499-1F	R6	47	DALE	RN60C4991F	RES 4.99KR .1W 1%
813-499-1F	R7	47	DALE	RN60C4991F	RES 4.99KR .1W 1%
813-499-1F	R13	47	DALE	RN60C4991F	RES 4.99KR .1W 1%
813-499-1F	R16	47	DALE	RN60C4991F	RES 4.99KR .1W 1%
801-333-05	R5	48	ALLEN BRADLEY	RC07GF333J	RES 33KR .25W 5%
801-333-05	R8	48	ALLEN BRADLEY	RC07GF333J	RES 33KR .25W 5%
801-333-05	R17	48	ALLEN BRADLEY	RC07GF333J	RES 33KR .25W 5%
801-333-05	R18	48	ALLEN BRADLEY	RC07GF333J	RES 33KR .25W 5%
813-499-3F	R10	49	DALE	RN60C4993F	RES 499KR .1W 1%
813-499-3F	R12	49	DALE	RN60C4993F	RES 499KR .1W 1%
813-100-1F	R9	50	DALE	RN60C1001F	RES 1KR .1W 1%
813-100-1F	R11	50	DALE	RN60C1001F	RES 1KR .1W 1%
819-501-99	R21	52	BOURNS	3299W-501	POT 500R CERMET
819-501-99	R22	52	BOURNS	3299W-501	POT 500R CERMET

COLUMN #1 Elgar Part
COLUMN #2 Reference Designator
COLUMN #3 Item # on Assy Dwg
COLUMN #4 Manufacturer
COLUMN #5 Manufacturer's Part #
COLUMN #6 Description

5809202-01 PHASE BOARD ASSEMBLY

COLUMN #1	#2	#3	#4	#5	#6
819-104-99	R19	53	BOURNS	3299W-104	POT 100KR CERMET
819-104-99	R20	53	BOURNS	3299W-104	POT 100KR CERMET
818-103-DR	RN3	54	BECKMAN	698-3-10K	RES NETWORK 10K
818-103-DR	RN4	54	BECKMAN	698-3-10K	RES NETWORK 10K
849-SIN-IV	U1	62	T.I.	TBP28L22N	PROM SINE/LOOK
849-SIN-IV	U14	62	T	TBP28L22N	PROM SINE/LOOK
849-401-74	U5	63	RCA	CD40174BE	CMOS HEX LATCH
849-401-74	U6	63	RCA	CD40174BE	CMOS HEX LATCH
849-401-74	U7	63	RCA	CD40174BE	CMOS HEX LATCH
849-401-74	U18	63	RCA	CD40174BE	CMOS HEX LATCH
849-401-74	U19	63	RCA	CD40174BE	CMOS HEX LATCH
849-LS1-69	U3	64	T.I.	SN74LS669N	IC BIN UP/DN CNTR
849-LS1-69	U4	64	T.I.	SN74LS669N	IC BIN UP/DN CNTR
849-LS1-69	U10	64	T.I.	SN74LS669N	IC BIN UP/DN CNTR
849-LS1-69	U11	64	T.I.	SN74LS669N	IC BIN UP/DN CNTR
849-LS1-69	U16	64	T.I.	SN74LS669N	IC BIN UP/DN CNTR
849-LS1-69	U17	64	T.I.	SN74LS669N	IC BIN UP/DN CNTR
849-LS3-0X	U2	65	T.I.	SN74LS30N	IC 8-IN NAND
849-LS3-0X	U15	65	T.I.	SN74LS30N	IC 8-IN NAND
849-LS7-4X	U12	66	T.I.	SN74LS74N	IC DUAU-D-FF
849-LS0-0X	U8	67	T.I.	SN74LS00N	IC 4x2IN NAND
849-LS0-0X	U9	67	T.I.	SN74LS00N	IC 4x2IN NAND
849-TL0-72	U20	68	T.I.	TL072CP	2XFET AMP
849-TL0-72	U23	68	T.I.	TL072CP	2XFET AMP
849-TL0-72	U24	68	T.I.	TL072CP	2XFET AMP
849-TL0-72	U25	68	T.I.	TL072CP	2XFET AMP
849-N50-08	U21	69	MOTOROLA	DAC08EP	IC 8 BIT DAC
849-N50-08	U22	69	MOTOROLA	DAC08EP	IC 8 BIT DAC
849-DIP-20	---	70	BURNDY	DILP20P-108	DIP SOCKET 20 PIN
849-H02-XX	U13	71	RCA	CD74HC02E	IC 4x2IN NOR

COLUMN #1 Elgar Part
COLUMN #2 Reference Designator
COLUMN #3 Item # on Assy Dwg
COLUMN #4 Manufacturer
COLUMN #5 Manufacturer's Part #
COLUMN #6 Description

5809204-01 PROCESSOR BOARD

COLUMN #1	#2	#3	#4	#5	#6
9809204-01	--	09	ELGAR	9809204-01	PROCESSOR BOARD
821-104-CK	C1	14	CENTRALAB	CK05BX104K	CAP .1uf 50V
821-104-CK	C2	14	CENTRALAB	CK05BX104K	CAP .1uf 50V
821-104-CK	C3	14	CENTRALAB	CK05BX104K	CAP .1uf 50V
821-104-CK	C4	14	CENTRALAB	CK05BX104K	CAP .1uf 50V
821-104-CK	C5	14	CENTRALAB	CK05BX104K	CAP .1uf 50V
821-104-CK	C6	14	CENTRALAB	CK05BX104K	CAP .1uf 50V
821-104-CK	C14	14	CENTRALAB	CK05BX104K	CAP .1uf 50V
821-104-CK	C15	14	CENTRALAB	CK05BX104K	CAP .1uf 50V
821-104-CK	C16	14	CENTRALAB	CK05BX104K	CAP .1uf 50V
821-104-CK	C17	14	CENTRALAB	CK05BX104K	CAP .1uf 50V
821-104-CK	C18	14	CENTRALAB	CK05BX104K	CAP .1uf 50V
821-104-CK	C23	14	CENTRALAB	CK05BX104K	CAP .1uf 50V
821-104-CK	C24	14	CENTRALAB	CK05BX104K	CAP .1uf 50V
821-104-CK	C25	14	CENTRALAB	CK05BX104K	CAP .1uf 50V
820-220-05	C7	15	CORNELL DUBLIER	CM05ED220J03	CAP 22pf 500V 5%
820-220-05	C8	15	CORNELL DUBLIER	CM05ED220J03	CAP 22pf 500V 5%
820-220-05	C20	15	CORNELL DUBLIER	CM05ED220J03	CAP 22pf 500V 5%
823-105-61	C22	16	SPRAGUE	196D105X0035JA1	CAP 1uf 35V
820-330-05	C9	18	CORNELL DUBLIER	CM05ED330J03	CAP 33pf 500V 5%
820-330-05	C10	18	CORNELL DUBLIER	CM05ED330J03	CAP 33pf 500V 5%
820-330-05	C11	18	CORNELL DUBLIER	CM05ED330J03	CAP 33pf 500V 5%
820-470-05	C21	19	CORNELL DUBLIER	CM05ED470J03	CAP 47pf 500V 5%
828-10X-70	C13	20	SPRAGUE	GZC70000	CAP VAR 10-70pf
823-106-41	C12	22	SPRAGUE	196D106X0020JA1	CAP 10uf 20V
823-106-41	C13	22	SPRAGUE	196D106X0020JA1	CAP 10uf 20V
823-106-41	C26	22	SPRAGUE	196D106X0020JA1	CAP 10uf 20V
848-329-BZ	CR1	25	NATIONAL	LM329BZ	DIODE REFERENCE
856-243-7X	J4	26	T&B ANSLEY	609-2437	CONN 24 PIN FLAT
832-P29-07	Q1	27	NATIONAL	PN2907	TRANSISTOR 40V
801-106-05	R1	30	ALLEN BRADLEY	RC07GF106J	RES 10MR .25W 5%
801-106-05	R6	30	ALLEN BRADLEY	RC07GF106J	RES 10MR .25W 5%
801-332-05	R13	31	ALLEN BRADLEY	RC07GF332J	RES 3.3KR .25W 5%
801-103-05	R9	32	ALLEN BRADLEY	RC07GF103J	RES 10KR .25W 5%
801-103-05	R12	32	ALLEN BRADLEY	RC07GF103J	RES 10KR .25W 5%
801-103-05	R14	32	ALLEN BRADLEY	RC07GF103J	RES 10KR .25W 5%
801-512-05	R7	33	ALLEN BRADLEY	RC07GF512J	RES 5.1KR .25W 5%
801-512-05	R8	33	ALLEN BRADLEY	RC07GF512J	RES 5.1KR .25W 5%
813-649-1F	R3	35	DALE	RN60C6491F	RES 6.49KR .1W 1%
813-649-1F	R4	35	DALE	RN60C6491F	RES 6.49KR .1W 1%
813-301-1F	R2	36	DALE	RN60C3011F	RES 3.01KR .1W 1%
818-222-SP	RN1	37	ALLEN BRADLEY	110A222	RES NETWORK 2.2KR
818-333-SP	RN2	39	ALLEN BRADLEY	110A333	RES NETWORK 33KR

COLUMN #1 Elgar Part
COLUMN #2 Reference Designator
COLUMN #3 Item # on Assy Dwg
COLUMN #4 Manufacturer
COLUMN #5 Manufacturer's Part #
COLUMN #6 Description

5809204-01 PROCESSOR BOARD

COLUMN #1	#2	#3	#4	#5	#6
801-223-05	R11	40	ALLEN BRADLEY	RC07GF223J	RES 22KR .25W 5%
801-223-05	R17	40	ALLEN BRADLEY	RC07GF223J	RES 22KR .25W 5%
860-206-5X	S1-5	42	CTS	206-5	DIP SWITCH 5PST
849-MEM-EN	U1	44	SIGNETICS	N82S23N W/PRGM	IC PROM MEM DECOD
849-273-2A	U2	45	INTEL	D2732A-4	IC EPROM
849-271-6X	U3	46	INTEL	D2716A-5	IC EPROM
849-611-62	U4	48	RCA	CDM6116AE2	IC SRAM 2Kx8
849-H37-3X	U5	49	NATIONAL	MM74HC373N	IC OCTAL LATCH
849-680-5E	U6	50	MOTOROLA	MC146805E2P	IC MICROPROCESSOR
849-741-67	U7	52	SIGNETICS	N74167PC	IC BCD RATE MULT
849-741-67	U8	52	SIGNETICS	N74167PC	IC BCD RATE MULT
849-741-67	U14	52	SIGNETICS	N74167PC	IC BCD RATE MULT
849-741-67	U15	52	SIGNETICS	N74167PC	IC BCD RATE MULT
849-7C3-74	U9	53	NATIONAL	MM74C374N	IC OCTAL LATCH
849-7C3-74	U10	53	NATIONAL	MM74C374N	IC OCTAL LATCH
849-7C3-74	U16	53	NATIONAL	MM74C374N	IC OCTAL LATCH
849-7C3-74	U20	53	NATIONAL	MM74C374N	IC OCTAL LATCH
849-H13-8X	U13	54	T.I.	SN74HC138N	IC 1 OF 8 DECODER
849-751-60	U30	55	T.I.	SN74HC138N	IC GPIB TX/RX
849-751-61	U29	56	T.I.	SN74HC138N	IC GPIB TX/RX
849-991-4A	U25	57	T.I.	TMS9914A	IC GPIB INTERFACE
849-H24-0X	U24	59	MOTOROLA	MC74HC240N	IC 8xINV TRISTATE
849-H00-XX	U26	60	MOTOROLA	MC74HC00N	IC 4x2IN NAND
849-H00-XX	U28	60	MOTOROLA	MC74HC00N	IC 4x2IN NAND
849-H74-XX	U22	62	MOTOROLA	MC74HC74N	IC DUAL-D-FF
849-TL0-72	U11	63	T.I.	TL072CP	2xFET AMP
849-TL0-72	U12	63	T.I.	TL072CP	2xFET AMP
849-754-5L	U17	65	ANALOG DEVICES	AD7545LN	IC 12 BIT DAC
849-754-5L	U18	65	ANALOG DEVICES	AD7545LN	IC 12 BIT DAC
849-754-5L	U19	65	ANALOG DEVICES	AD7545LN	IC 12 BIT DAC
849-H39-0X	U27	66	MOTOROLA	MC74HC390N	IC 2xDECADE CNTR
849-H20-XX	U21	67	MOTOROLA	MC74HC20N	IC 2x4IN NAND
849-H02-XX	U31	70	RCA	CD74HC02E	IC 4x2IN NAND
849-H04-XX	U23	71	RCA	CD74HC04E	IC HEX INVERTER
849-78L-05	VR1	72	FAIRCHILD	UA78L05AWC	REGULATOR 5V
864-5MH-ZP	Y1	75	SARONIX	NYP050-20	CRYSTAL PAR 5MHZ
864-720-0K	Y2	76	MONITOR PRODUCT	MC18A32PF7.2MHZ	CRYSTAL PAR 7.2M
835-364-3P	Q2	78	NATIONAL	PN3643	TRANSISTOR 30V
801-333-05	R10	80	ALLEN BRADLEY	RC07GF333J	RES 33KR .25W 5%
109-A15-30	---	84	USECO	A1530B-5/8-16	STANDOFF #6 5/8IN
849-DIP-16	---	86	BURNDY	DILB16P-108	DIP SOCKET 16 PIN
849-DIP-24	---	87	BURNDY	DILB24P-108	DIP SOCKET 24 PIN
849-DIP-40	---	88	BURNDY	DILB40P-108	DIP SOCKET 40 PIN

COLUMN #1 Elgar Part
COLUMN #2 Reference Designator
COLUMN #3 Item # on Assy Dwg
COLUMN #4 Manufacturer
COLUMN #5 Manufacturer's Part #
COLUMN #6 Description

5809201-01 MAIN BOARD

COLUMN #1	#2	#3	#4	#5	#6
9809201-01	--	09	ELGAR	9809201-01	MAIN BOARD
821-104-CK	C11	14	CENTRALAB	CK05BX104K	CAP .1uf 50V
820-470-05	C12	16	CORNELL DUBLIER	CM05ED470J03	CAP 47pf 500V 5%
821-102-00	C10	17	CENTRALAB	DDM102	CAP .001uf 1000V
823-336-51	C15	18	SPRAGUE	196D336X0025PE4	CAP 33uf 25V
823-336-51	C16	18	SPRAGUE	196D336X0025PE4	CAP 33uf 25V
823-105-61	C18	19	SPRAGUE	196D105X0035JA1	CAP 1uf 25V
824-478-01	C14	20	PANASONIC	ECE-B1CV472S	CAP 4700uf 16V
820-102-01	C8	21	CORNELL DUBLIER	CD15FA102F03	CAP 1000pf 100V
820-252-01	C7	22	CORNELL DUBLIER	CD15FA252F03	CAP 2500pf 500V
820-151-05	C9	23	CORNELL DUBLIER	CM05FD151J03	CAP 150pf 500V
823-474-61	C1	24	SPRAGUE	196D474X0035HA1	CAP .47uf 35V
823-474-61	C3	24	SPRAGUE	196D474X0035HA1	CAP .47uf 35V
823-474-61	C5	24	SPRAGUE	196D474X0035HA1	CAP .47uf 35V
845-582-2X	CR12	34	MOTOROLA	1N5822	DIODE SCHOTTKY 3A
845-582-2X	CR13	34	MOTOROLA	1N5822	DIODE SCHOTTKY 3A
845-582-2X	CR14	34	MOTOROLA	1N5822	DIODE SCHOTTKY 3A
845-582-2X	CR15	34	MOTOROLA	1N5822	DIODE SCHOTTKY 3A
844-914-XX	CR1	35	MOTOROLA	1N914	DIODE
844-914-XX	CR2	35	MOTOROLA	1N914	DIODE
844-914-XX	CR3	35	MOTOROLA	1N914	DIODE
844-914-XX	CR4	35	MOTOROLA	1N914	DIODE
844-914-XX	CR5	35	MOTOROLA	1N914	DIODE
844-914-XX	CR6	35	MOTOROLA	1N914	DIODE
844-914-XX	CR7	35	MOTOROLA	1N914	DIODE
844-914-XX	CR8	35	MOTOROLA	1N914	DIODE
844-914-XX	CR9	35	MOTOROLA	1N914	DIODE
844-914-XX	CR16	35	MOTOROLA	1N914	DIODE
844-914-XX	CR18	35	MOTOROLA	1N914	DIODE
844-914-XX	CR20	35	MOTOROLA	1N914	DIODE
844-914-XX	CR21	35	MOTOROLA	1N914	DIODE
844-914-XX	CR22	35	MOTOROLA	1N914	DIODE
844-914-XX	CR23	35	MOTOROLA	1N914	DIODE
843-474-4A	CR17	36	MOTOROLA	1N4744A	DIODE ZENER 15V
843-474-4A	CR19	36	MOTOROLA	1N4744A	DIODE ZENER 15V
823-106-41	C17	37	SPRAGUE	196D106X0020JA1	CAP 10uf 20V
856-402-7E	P2	46	T&B ANSLEY	609-4027E	CONN 40 PIN FLAT
842-TIP-30	Q3	47	T.I.	TIP30B	TRANSISTOR 80V
835-364-3P	Q1	55	NATIONAL	PN3643	TRANSISTOR 30V
835-364-3P	Q5	55	NATIONAL	PN3643	TRANSISTOR 30V
835-364-3P	Q6	55	NATIONAL	PN3643	TRANSISTOR 30V
835-364-3P	Q7	55	NATIONAL	PN3643	TRANSISTOR 30V
835-364-3P	Q8	55	NATIONAL	PN3643	TRANSISTOR 30V
842-TIP-29	Q2	56	T.I.	TIP29B	TRANSISTOR 80V

COLUMN #1 Elgar Part
COLUMN #2 Reference Designator
COLUMN #3 Item # on Assy Dwg
COLUMN #4 Manufacturer
COLUMN #5 Manufacturer's Part #
COLUMN #6 Description

5809201-01 MAIN BOARD

COLUMN #1	#2	#3	#4	#5	#6
842-SD2-13	Q4	57	SEMI PROCESSES	SD213DE	MOSFET 30V
801-222-05	R40	65	ALLEN BRADLEY	RC07GF222J	RES 2.2KR .25W 5%
801-222-05	R43	65	ALLEN BRADLEY	RC07GF222J	RES 2.2KR .25W 5%
801-511-05	R63	66	ALLEN BRADLEY	RC07GF511J	RES 510R .25W 5%
801-333-05	R52	67	ALLEN BRADLEY	RC07GF333J	RES 33KR .25W 5%
801-333-05	R53	67	ALLEN BRADLEY	RC07GF333J	RES 33KR .25W 5%
801-333-05	R54	67	ALLEN BRADLEY	RC07GF333J	RES 33KR .25W 5%
801-333-05	R59	67	ALLEN BRADLEY	RC07GF333J	RES 33KR .25W 5%
801-333-05	R61	67	ALLEN BRADLEY	RC07GF333J	RES 33KR .25W 5%
813-499-1F	R27	68	DALE	RN60C4991F	RES 4.99KR .1W 1%
813-499-1F	R60	68	DALE	RN60C4991F	RES 4.99KR .1W 1%
813-324-1F	R28	69	DALE	RN60C3241F	RES 3.24KR .1W 1%
813-324-1F	R29	69	DALE	RN60C3241F	RES 3.24KR .1W 1%
801-472-05	R44	70	ALLEN BRADLEY	RC07GF472J	RES 4.7KR .25W 5%
801-680-05	R64	71	ALLEN BRADLEY	RC07GF680J	RES 68R .25W 5%
801-680-05	R65	71	ALLEN BRADLEY	RC07GF680J	RES 68R .25W 5%
801-221-05	R66	72	ALLEN BRADLEY	RC07GF221J	RES 220R .25W 5%
801-221-05	R67	72	ALLEN BRADLEY	RC07GF221J	RES 220R .25W 5%
813-499-3F	R20	73	DALE	RN60C4993F	RES 499KR .1W 1%
813-499-3F	R25	73	DALE	RN60C4993F	RES 499KR .1W 1%
813-499-3F	R35	73	DALE	RN60C4993F	RES 499KR .1W 1%
813-499-3F	R47	73	DALE	RN60C4993F	RES 499KR .1W 1%
813-100-1F	R19	74	DALE	RN60C1001F	RES 1KR .1W 1%
813-100-1F	R26	74	DALE	RN60C1001F	RES 1KR .1W 1%
813-100-1F	R34	74	DALE	RN60C1001F	RES 1KR .1W 1%
813-100-1F	R46	74	DALE	RN60C1001F	RES 1KR .1W 1%
801-103-05	R62	75	ALLEN BRADLEY	RC07GF103J	RES 10KR .25W 5%
818-390-3E	R15	76	DALE	RN65E3903F	RES 390KR .5W 1%
818-390-3E	R16	76	DALE	RN65E3903F	RES 390KR .5W 1%
818-390-3E	R17	76	DALE	RN65E3903F	RES 390KR .5W 1%
818-390-3E	R30	76	DALE	RN65E3903F	RES 390KR .5W 1%
818-390-3E	R31	76	DALE	RN65E3903F	RES 390KR .5W 1%
818-390-3E	R32	76	DALE	RN65E3903F	RES 390KR .5W 1%
813-976-1F	R18	77	DALE	RN60C9761F	RES 9.76KR.1W 1%
813-976-1F	R33	77	DALE	RN60C9761F	RES 9.76KR.1W 1%
813-976-1F	R45	77	DALE	RN60C9761F	RES 9.76KR.1W 1%
801-153-05	R24	78	ALLEN BRADLEY	RC07GF153J	RES 15KR .25W 5%
801-153-05	R39	78	ALLEN BRADLEY	RC07GF153J	RES 15KR .25W 5%
801-153-05	R41	78	ALLEN BRADLEY	RC07GF153J	RES 15KR .25W 5%
801-153-05	R42	78	ALLEN BRADLEY	RC07GF153J	RES 15KR .25W 5%
801-153-05	R51	78	ALLEN BRADLEY	RC07GF153J	RES 15KR .25W 5%
801-332-05	R23	79	ALLEN BRADLEY	RC07GF332J	RES 3.3KR .25W 5%
801-332-05	R38	79	ALLEN BRADLEY	RC07GF332J	RES 3.3KR .25W 5%
801-332-05	R50	79	ALLEN BRADLEY	RC07GF332J	RES 3.3KR .25W 5%

COLUMN #1 Elgar Part
COLUMN #2 Reference Designator
COLUMN #3 Item # on Assy Dwg
COLUMN #4 Manufacturer
COLUMN #5 Manufacturer's Part #
COLUMN #6 Description

5809201-01 MAIN BOARD

COLUMN #1	#2	#3	#4	#5	#6
801-332-05	R69	79	ALLEN BRADLEY	RC07GF332J	RES 3.3KR .25W 5%
813-348-1F	R21	80	DALE	RN60C3481F	RES 3.48KR .1W 1%
813-348-1F	R36	80	DALE	RN60C3481F	RES 3.48KR .1W 1%
813-348-1F	R48	80	DALE	RN60C3481F	RES 3.48KR .1W 1%
801-101-05	R22	81	ALLEN BRADLEY	RC07GF101J	RES 100R .25W 5%
801-101-05	R37	81	ALLEN BRADLEY	RC07GF101J	RES 100R .25W 5%
801-101-05	R49	81	ALLEN BRADLEY	RC07GF101J	RES 100R .25W 5%
802-332-05	R55	82	ALLEN BRADLEY	RC07GF332J	RES 3.3KR .25W 5%
802-332-05	R56	82	ALLEN BRADLEY	RC07GF332J	RES 3.3KR .25W 5%
801-3R9-05	R57	83	ALLEN BRADLEY	RC07GF3R9J	RES 3.9R .25W 5%
801-3R9-05	R58	83	ALLEN BRADLEY	RC07GF3R9J	RES 3.9R .25W 5%
819-104-99	R7	84	BOURNS	3299W-1-104	POT 100KR CERMET
819-104-99	R8	84	BOURNS	3299W-1-104	POT 100KR CERMET
819-104-99	R9	84	BOURNS	3299W-1-104	POT 100KR CERMET
819-104-99	R14	84	BOURNS	3299W-1-104	POT 100KR CERMET
819-501-99	R1	85	BOURNS	3299W-1-501	POT 500R CERMET
819-501-99	R2	85	BOURNS	3299W-1-501	POT 500R CERMET
819-501-99	R3	85	BOURNS	3299W-1-501	POT 500R CERMET
819-501-99	R13	85	BOURNS	3299W-1-501	POT 500R CERMET
819-502-64	R10	86	SPECTROL	64W502	POT 5KR CERMET
819-502-64	R11	86	SPECTROL	64W502	POT 5KR CERMET
819-502-64	R12	86	SPECTROL	64W502	POT 5KR CERMET
819-102-32	R4	87	BOURNS	3255W-1-102	POT 1KR CERMET
860-76S-01	S1	88	GRAYHILL	76SD01	DIP SWITCH DPDT
850-16V-12	T1	90	TRIAD	FP16-750	TRANFORMER 16V
849-LS1-0X	U1	97	T.I.	SN74LS10N	IC 3x3IN NAND
849-LS0-0X	U23	98	T.I.	SN74LS00N	IC 4x2IN NAND
849-LS1-32	U31	99	T.I.	SN74LS132N	IC 4x2IN NAND
849-H12-6X	U32	100	MOTOROLA	CD74HC126E	IC 4xNONINVERT
849-C40-13	U25	101	RCA	CD4013BE	IC DUAL D F-F
849-C40-13	U29	101	RCA	CD4013BE	IC DUAL D F-F
849-LS1-69	U3	102	T.I.	SN74LS169N	IC BIN UP DN CNTR
849-LS1-69	U7	102	T.I.	SN74LS169N	IC BIN UP DN CNTR
849-LS1-69	U14	102	T.I.	SN74LS169n	IC BIN UP DN CNTR
849-LS7-4X	U2	103	T.I.	SN74LS74N	IC DUAL D F-F
849-7C3-74	U18	104	NATIONAL	MM74LS374N	IC OCTAL LATCH
849-LS3-0X	U17	105	T.I.	SN74LS30N	IC 8-IN NAND
849-TL0-72	U5	106	TEXAS INSRUMENT	TL072CP	IC 2XFET OP AMP
849-TL0-72	U8	106	TEXAS INSRUMENT	TL072CP	IC 2XFET OP AMP
849-TL0-72	U10	106	TEXAS INSRUMENT	TL072CP	IC 2XFET OP AMP
849-TL0-72	U11	106	TEXAS INSRUMENT	TL072CP	IC 2XFET OP AMP
849-TL0-72	U19	106	TEXAS INSRUMENT	TL072CP	IC 2XFET OP AMP
849-TL0-72	U21	106	TEXAS INSRUMENT	TL072CP	IC 2XFET OP AMP
849-TL0-72	U26	106	TEXAS INSRUMENT	TL072CP	IC 2XFET OP AMP

COLUMN #1 Elgar Part
COLUMN #2 Reference Designator
COLUMN #3 Item # on Assy Dwg
COLUMN #4 Manufacturer
COLUMN #5 Manufacturer's Part #
COLUMN #6 Description

5809201-01 MAIN BOARD

COLUMN #1	#2	#3	#4	#5	#6
849-TL0-72	U28	106	T.I.	TL072CP	IC 2XFET OP AMP
849-SIN IV	U13	107	T.I.	TBP28L22N	PROM SIN LOOK
849-N50-08	U6	108	MOTOROLA	DAC08EP	CONV 8 BIT DAC
849-LM3-39	U16	109	MOTOROLA	LM339N	IC QUAD OP AMP
849-LM3-39	U22	109	MOTOROLA	LM339N	IC QUAD OP AMP
849-754-62	U30	110	T.I.	SN75462P	IC 2XNAND-DRIV
849-CLM-51	U4	112	CLAIREX	CLM51	IC PHOTO MOD
849-CLM-51	U15	112	CLAIREX	CLM51	IC PHOTO MOD
849-CLM-51	U24	112	CLAIREX	CLM51	IC PHOTO MOD
849-DIP-20	---	120	BURNDY	DILB20P-108	DIP SOCKET 20 PIN
849-780-5P	VR1	123	FAIRCHILD	UA7805UC	VOLT REG +5VDC
109-A15-30	---	124	USECO	A15308-5/8-16	STANDOFF #6 5/8IN

COLUMN #1 Elgar Part
COLUMN #2 Reference Designator
COLUMN #3 Item # on Assy Dwg
COLUMN #4 Manufacturer
COLUMN #5 Manufacturer's Part #
COLUMN #6 Description

5809203-01 DISPLAY BOARD

COLUMN #1	#2	#3	#4	#5	#6
9809203-01	---	09	ELGAR	9809203-01	DISPLAY BOARD
5970075-01	---	12	ELGAR	5970075-01	INTERCONN CABLE
860-KEY-PD	---	14	GRAYHILL	88BA2	KEYBOARD PAD
860-KEY-01	---	15	ELGAR	849-KEY-01	OVERLAY, KEYBOARD
821-104-CK	C1	22	CENTRALAB	CK05BX104K	CAP .1uf 50V
823-107-21	C2	23	SPRAGUE	196D107X001[illegible]PE4	CAP 100uf 10V
823-105-61	C3	24	SPRAGUE	196D105X0035JA1	CAP 1uf 35V
823-106-41	C4	25	SPRAGUE	196D106X0020JA1	CAP 10uf 20V
848-461-0X	DS1	33	MONSANTO	MAN4610	DISPLAY 7 SEGMENT
848-461-0X	DS2	33	MONSANTO	MAN4610	DISPLAY 7 SEGMENT
848-461-0X	DS3	33	MONSANTO	MAN4610	DISPLAY 7 SEGMENT
848-461-0X	DS4	33	MONSANTO	MAN4610	DISPLAY 7 SEGMENT
848-655-02	DS5	34	HEWLETT PACKARD	HLMP-3301	LED, RED WIDE ANG
848-655-02	DS6	34	HEWLETT PACKARD	HLMP-3301	LED, RED WIDE ANG
848-655-02	DS7	34	HEWLETT PACKARD	HLMP-3301	LED, RED WIDE ANG
848-655-02	DS8	34	HEWLETT PACKARD	HLMP-3301	LED, RED WIDE ANG
848-655-02	DS9	34	HEWLETT PACKARD	HLMP-3301	LED, RED WIDE ANG
848-655-02	DS10	34	HEWLETT PACKARD	HLMP-3301	LED, RED WIDE ANG
848-655-02	DS11	34	HEWLETT PACKARD	HLMP-3301	LED, RED WIDE ANG
848-655-02	DS12	34	HEWLETT PACKARD	HLMP-3301	LED, RED WIDE ANG
848-655-02	DS13	34	HEWLETT PACKARD	HLMP-3301	LED, RED WIDE ANG
801-753-05	R5	37	ALLEN BRADLEY	RC07GF753F	RES 75KR .25W 5%
804-100-05	R1	38	ALLEN BRADLEY	RC42GF100F	RES 10R 2W 5%
801-333-05	R2	39	ALLEN BRADLEY	RC07GF333F	RES 33KR .25W 5%
801-333-05	R2	39	ALLEN BRADLEY	RC07GF333F	RES 33KR .25W 5%
801-104-05	R4	40	ALLEN BRADLEY	RC07GF104F	RES 100KR .25W 5%
818-750-DP	RN1	41	ALLEN BRADLEY	316B750	RES PACK DIP 75R
818-103-SP	RN2	42	ALLEN BRADLEY	110A103	RES PACK SIP 10KR
849-721-8C	U1	48	MAXIM	ICM7218CIPI	IC 8X7 SEG DISP
849-7C3-74	U2	49	NATIONAL	MM74C374N	IC OCTAL LATCH
849-C40-71	U3	50	RCA	CD4071BE	IC 4X2 IN OR GATE
849-H74-XX	U4	51	NATIONAL	MM74C74N	IC DUAL D F-F
109-267-2X	---	56	H.H.SMITH	2672	SHLDR WASHER #4
109-908-08	---	60	ELGAR	109-908-08	LED MTG SPACER
849-DIP-14	---	61	BURNDY	DILB14P-108	DIP SOCKET 14 PIN

COLUMN #1 Elgar Part
COLUMN #2 Reference Designator
COLUMN #3 Item # on Assy Dwg
COLUMN #4 Manufacturer
COLUMN #5 Manufacturer's Part #
COLUMN #6 Description

5809205-01 TEST BOARD

COLUMN #1	#2	#3	#4	#5	#6
9809205-01	---	09	ELGAR	9809205-01	TEST BOARD
823-106-41	C19	18	SPRAGUE	196D106X0020JA1	CAP 10uf 20V
823-106-41	C20	18	SPRAGUE	196D106X0020JA1	CAP 10uf 20V
823-106-41	C23	18	SPRAGUE	196D106X0020JA1	CAP 10uf 20V
823-106-41	C24	18	SPRAGUE	196D106X0020JA1	CAP 10uf 20V
823-106-41	C26	18	SPRAGUE	196D106X0020JA1	CAP 10uf 20V
823-106-41	C27	18	SPRAGUE	196D106X0020JA1	CAP 10uf 20V
823-106-41	C30	18	SPRAGUE	196D106X0020JA1	CAP 10uf 20V
821-104-CK	C1	19	CENTRALAB	CK05BX104K	CAP .1uf 50V
821-104-CK	C2	19	CENTRALAB	CK05BX104K	CAP .1uf 50V
821-104-CK	C3	19	CENTRALAB	CK05BX104K	CAP .1uf 50V
821-104-CK	C4	19	CENTRALAB	CK05BX104K	CAP .1uf 50V
821-104-CK	C5	19	CENTRALAB	CK05BX104K	CAP .1uf 50V
821-104-CK	C6	19	CENTRALAB	CK05BX104K	CAP .1uf 50V
821-104-CK	C7	19	CENTRALAB	CK05BX104K	CAP .1uf 50V
821-104-CK	C8	19	CENTRALAB	CK05BX104K	CAP .1uf 50V
821-104-CK	C9	19	CENTRALAB	CK05BX104K	CAP .1uf 50V
821-104-CK	C29	19	CENTRALAB	CK05BX104K	CAP .1uf 50V
821-104-CK	C31	19	CENTRALAB	CK05BX104K	CAP .1uf 50V
822-392-11	C12	20	SPRAGUE	192P39292	CAP .0039uf 100V
822-222-05	C10	10	SPRAGUE	192P22392	CAP .0022uf 200V
820-561-05	C18	22	CORNELL DUBLIER	CM06FD561J03	CAP 560pf 500V
822-274-PP	C15	23	IMB	GA2C274F	CAP .27uf 1%
822-824-PP	C14	24	IMB	GA2C824F	CAP .82uf 1%
822-105-PP	C16	25	IMB	GA2C105F	CAP 1uf 1%
823-105-61	C25	26	SPRAGUE	196D105X0035JA1	CAP 1uf 35V
822-684-12	C13	29	ELPAC	B1B684F	CAP .68uf 100V 1%
820-330-05	C11	30	CORNELL DUBLIER	CM05ED330J03	CAP 33pf 500V 5%
820-330-05	C21	30	CORNELL DUBLIER	CM05ED330J03	CAP 33pf 500V 5%
820-100-05	C22	31	CORNELL DUBLIER	CM05CD100J03	CAP 10pf 500V 5%
819-102-32	R1	33	BOURNS	3299W-1-102	POT 1KR 25 TURN
819-104-99	R6	34	BOURNS	3296W-1-104	POT 100KR 25 TURN
819-104-99	R7	34	BOURNS	3296W-1-104	POT 100KR 25 TURN
819-104-99	R8	34	BOURNS	3296W-1-104	POT 100KR 25 TURN
819-104-99	R9	34	BOURNS	3296W-1-104	POT 100KR 25 TURN
819-501-99	R2	35	BOURNS	3299W-1-501	POT 500R 25 TURN
819-501-99	R3	35	BOURNS	3299W-1-501	POT 500R 25 TURN
819-501-99	R4	35	BOURNS	3299W-1-501	POT 500R 25 TURN
819-501-99	R5	35	BOURNS	3299W-1-501	POT 500R 25 TURN
819-501-99	R11	35	BOURNS	3299W-1-501	POT 500R 25 TURN
819-202-64	R12	36	BOURNS	3299W-1-202	POT 2KR 25 TURN
819-203-99	R10	37	BOURNS	3299W-1-203	POT 20KR 25 TURN
848-329-BZ	CR9	40	NATIONAL	LM329BZ	REF 1mA 6.2V

COLUMN #1 Elgar Part
COLUMN #2 Reference Designator
COLUMN #3 Item # on Assy Dwg
COLUMN #4 Manufacturer
COLUMN #5 Manufacturer's Part #
COLUMN #6 Description

5809205-01 TEST BOARD

COLUMN #1	#2	#3	#4	#5	#6
844-914-XX	CR1	41	MOTOROLA	1N914	DIODE
844-914-XX	CR2	41	MOTOROLA	1N914	DIODE
844-914-XX	CR3	41	MOTOROLA	1N914	DIODE
844-914-XX	CR4	41	MOTOROLA	1N914	DIODE
844-914-XX	CR5	41	MOTOROLA	1N914	DIODE
844-914-XX	CR6	41	MOTOROLA	1N914	DIODE
844-914-XX	CR7	41	MOTOROLA	1N914	DIODE
844-914-XX	CR8	41	MOTOROLA	1N914	DIODE
849-758-2K	U3	42	ANALOG DEVICES	AD7582KN	IC DAC 12 BIT
849-434-1X	U29	43	BURR BROWN	4341	IC TRMS CONVERTOR
849-AD6-32	U26	44	ANALOG DEVICES	AD632A	IC ANA MULTIPLIER
849-DG2-01	U23	45	ANALOG DEVICES	DG201A	IC ANA SWITCH
849-DG2-01	U25	45	ANALOG DEVICES	DG201A	IC ANA SWITCH
849-DG2-01	U28	45	ANALOG DEVICES	DG201A	IC ANA SWITCH
849-340-2A	U17	46	MOTOROLA	MC34002A	IC 2XFET AMP
849-340-2A	U22	46	MOTOROLA	MC34002A	IC 2XFET AMP
849-340-2A	U24	46	MOTOROLA	MC34002A	IC 2XFET AMP
849-340-2A	U27	46	MOTOROLA	MC34002A	IC 2XFET AMP
849-79L-05	VR1	47	NATIONAL	LM79L05ACZ	REG -5VDC
835-364-3P	Q1	48	NATIONAL	PN3643	TRANSISTOR 30V
801-223-05	R58	49	ALLEN BRADLEY	RC07GF223F	RES 1/4W 22KR 5%
813-576-2F	R15	50	DALE	RN60C5762F	RES 1/8W 57.6K 1%
813-374-1F	R20	51	DALE	RN60C3741F	RES 1/8W 3.74K 1%
813-374-1F	R39	51	DALE	RN60C3741F	RES 1/8W 3.74K 1%
813-374-1F	R40	51	DALE	RN60C3741F	RES 1/8W 3.74K 1%
813-374-1F	R50	51	DALE	RN60C3741F	RES 1/8W 3.74K 1%
813-200-1F	R21	52	DALE	RN60C2001F	RES 1/8W 2.00K 1%
813-200-1F	R52	52	DALE	RN60C2001F	RES 1/8W 2.00K 1%
813-649-1F	R22	53	DALE	RN60C6491F	RES 1/8W 6.49K 1%
813-200-2F	R17	54	DALE	RN60C2002F	RES 1/8W 20.0K 1%
813-200-2F	R18	54	DALE	RN60C2002F	RES 1/8W 20.0K 1%
813-200-2F	R42	54	DALE	RN60C2002F	RES 1/8W 20.0K 1%
813-200-2F	R46	54	DALE	RN60C2002F	RES 1/8W 20.0K 1%
813-200-2F	R53	54	DALE	RN60C2002F	RES 1/8W 20.0K 1%
813-200-2F	R54	54	DALE	RN60C2002F	RES 1/8W 20.0K 1%
813-221-2F	R19	55	DALE	RN60C2212F	RES 1/8W 22.1K 1%
813-402-2F	R56	56	DALE	RN60C4022F	RES 1/8W 40.2K 1%
813-365-1F	R55	57	DALE	RN60C3651F	RES 1/8W 3.65K 1%
813-115-2F	R30	58	DALE	RN60C1152F	RES 1/8W 11.5K 1%
813-115-2F	R31	58	DALE	RN60C1152F	RES 1/8W 11.5K 1%
813-115-2F	R41	58	DALE	RN60C1152F	RES 1/8W 11.5K 1%
813-115-2F	R43	58	DALE	RN60C1152F	RES 1/8W 11.5K 1%
813-115-2F	R44	58	DALE	RN60C1152F	RES 1/8W 11.5K 1%
813-115-2F	R45	58	DALE	RN60C1152F	RES 1/8W 11.5K 1%

COLUMN #1 Elgar Part
COLUMN #2 Reference Designator
COLUMN #3 Item # on Assy Dwg
COLUMN #4 Manufacturer
COLUMN #5 Manufacturer's Part #
COLUMN #6 Description

5809205-01 TEST BOARD

COLUMN #1	#2	#3	#4	#5	#6
813-100-3F	R48	59	DALE	RN60C1003F	RES 1/8W 100KR 1%
813-100-3F	R49	59	DALE	RN60C1003F	RES 1/8W 100KR 1%
813-100-1F	R32	60	DALE	RN60C1001F	RES 1/8W 1KR 1%
813-100-1F	R47	60	DALE	RN60C1001F	RES 1/8W 1KR 1%
818-15T-2F	R27	61	DALE	CMF60-15 OHM-T2	RES 1/4W 15R 1%
818-15T-2F	R28	61	DALE	CMF60-15 OHM-T2	RES 1/4W 15R 1%
818-15T-2F	R29	61	DALE	CMF60-15 OHM-T2	RES 1/4W 15R 1%
816-536-3F	R33	62	DALE	RN65C5363F	RES 1/4W 536KR 1%
816-536-3F	R34	62	DALE	RN65C5363F	RES 1/4W 536KR 1%
816-536-3F	R35	62	DALE	RN65C5363F	RES 1/4W 536KR 1%
816-536-3F	R36	62	DALE	RN65C5363F	RES 1/4W 536KR 1%
816-536-3F	R37	62	DALE	RN65C5363F	RES 1/4W 536KR 1%
816-536-3F	R38	62	DALE	RN65C5363F	RES 1/4W 536KR 1%
801-332-05	R13	63	ALLEN BRADLEY	RC07GF332F	RES 1/4W 3.3KR 5%
801-332-05	R23	63	ALLEN BRADLEY	RC07GF332F	RES 1/4W 3.3KR 5%
801-332-05	R24	63	ALLEN BRADLEY	RC07GF332F	RES 1/4W 3.3KR 5%
801-332-05	R57	63	ALLEN BRADLEY	RC07GF332F	RES 1/4W 3.3KR 5%
801-474-05	R26	64	ALLEN BRADLEY	RC07GF474F	RES 1/4W 470KR 5%
801-155-05	R14	65	ALLEN BRADLEY	RC07GF155F	RES 1/4W 1.5MR 5%
801-335-05	R51	66	ALLEN BRADLEY	RC07GF335F	RES 1/4W 3.3MR 5%
801-106-05	R25	67	ALLEN BRADLEY	RC07GF106F	RES 1/4W 10MKR 5%
861-DIP-FB	K1	68	POTTER&BRUMFLD	JWD171-17	RELAY 1 FORM B 5V
801-123-05	R16	69	ALLEN BRADLEY	RC07GF123F	RES 1/4W 12KR 5%
849-7C3-74	U7	70	NATIONAL	MM74C374N	IC OCTAL LATCH
849-H37-3X	U2	71	MOTOROLA	CD74HC373E	IC OCTAL LATCH
849-H37-3X	U5	71	MOTOROLA	CD74HC373E	IC OCTAL LATCH
849-H13-9X	U14	72	RCA	CD74HC4520E	IC 2X2TO4 DECIMAL
849-H45-20	U1	73	RCA	CD74HC4520E	IC 2XBINARY COUNT
849-H45-20	U4	73	RCA	CD74HC4520E	IC 2XBINARY COUNT
849-H45-20	U18	73	RCA	CD74HC4520E	IC 2XBINARY COUNT
849-H45-20	U19	73	RCA	CD74HC4520E	IC 2XBINARY COUNT
849-H74-XX	U12	74	NATIONAL	MM74HC74N	IC DUAL D F/F
849-H74-XX	U15	74	NATIONAL	MM74HC74N	IC DUAL D F/F
849-H74-XX	U16	74	NATIONAL	MM74HC74N	IC DUAL D F/F
849-401-06	U13	75	RCA	CD40106BE	IC HEX ISCHMIDT
849-H00-XX	U6	76	T.I.	SN74HC00N	IC 4X2IN NAND
849-H15-7X	U9	77	RCA	CD74HC157E	IC 4X2 DATASELECT
849-H10-XX	U10	78	T.I.	SN74HC10N	IC 3X3IN NAND
849-LM3-11	U20	79	NATIONAL	LM311H	IC DUAL COMPARATR
849-LM3-11	U21	79	NATIONAL	LM311H	IC DUAL COMPARATR
849-LM3-11	U30	79	NATIONAL	LM311H	IC DUAL COMPARATR
849-C40-98	U11	80	RCA	CD4098BE	IC 4X2IN SCHMIDT
849-LS1-75	U32	81	NATIONAL	DM74LS175N	IC 4 BIT LATCH
849-H02-XX	U31	82	RCA	CD74HC02E	IC 4X2IN NOR

COLUMN #1 Elgar Part
COLUMN #2 Reference Designator
COLUMN #3 Item # on Assy Dwg
COLUMN #4 Manufacturer
COLUMN #5 Manufacturer's Part #
COLUMN #6 Description

5809205-01 TEST BOARD

COLUMN #1	#2	#3	#4	#5	#6
864-327-68	Y1	90	SARONIX	CX1VB03 32768HZ	CRYSTAL 32.768KHZ
856-523-4Z	J2	91	MOLEX	10-33-1104	CONNECTOR 15 PIN
849-DIP-14	---	92	BURNDY	DILB14P-108	DIP SOCKET 14 PIN
849-DIP-28	---	93	BURNDY	DILB28P-108	DIP SOCKET 28 PIN
995-511-13	---	95	COMMERCIAL	22AWG TINNED CU	BUSS WIRE 22AWG
9950511-04	---	96	COMMERCIAL	TFE 20AWG	TEFLON SLEEVING

COLUMN #1 Elgar Part
COLUMN #2 Reference Designator
COLUMN #3 Item # on Assy Dwg
COLUMN #4 Manufacturer
COLUMN #5 Manufacturer's Part #
COLUMN #6 Description

5809200-01 FINAL ASSEMBLY 9023

COLUMN #1	#2	#3	#4	#5	#6
5809205-01	---	09	ELGAR	5809205-01	TEST BOARD ASSY
5809204-01	---	10	ELGAR	5809204-01	PROCESSOR BD ASSY
5809202-01	---	11	ELGAR	5809202-01	PHASE BOARD ASSY
5809201-01	---	12	ELGAR	5809201-01	MAIN BOARD ASSY
9809206-01	---	13	ELGAR	9809206-01	FRONT PANEL 9023
9809207-01	---	14	ELGAR	9809207-01	FILTER POLARIZER
899-263-09	---	15	SOUTHCO	51-16-709-24	SCREW/FERRULE
899-242-0X	---	16	ELGAR	899-242-20	LABEL WARNING
842-TIP-29	Q2	17	T.I.	TIP29B	TRANSISTOR NPN80V
842-TIP-30	Q3	18	T.I.	TIP30B	TRANSISTOR PNP80V
849-780-5P	VR1	19	FAIRCHILD	UA7805UC	REGULATOR +5VDC
5809203-01	---	20	ELGAR	5809203-01	DISPLAY BD ASSY
109-093-SW	---	30	AMATOM	2630-14020-N093	SHOULDER WASHER
109-220-PD	---	31	BERGQUIST	3223-07FR-56	INSULATOR TO220
109-302-2X	---	32	H.H.SMITH	3022	HINGED STANDOFF
109-302-7X	---	33	H.H.SMITH	3027	HINGED STANDOFF
110DA04-06	---	34	COMMERCIAL	#6-32 X 3/8	SCREW PAN HEAD
110DA04-04	---	35	COMMERCIAL	#6-32 X 1/4	SCREW PAN HEAD
110DA04-16	---	36	COMMERCIAL	#6-32 X 1	SCREW PAN HEAD
110DH04-08	---	37	COMMERCIAL	#6-32 X 1/2	SCREW BINDER HEAD
110CA04-04	---	38	COMMERCIAL	#4-40 X 1/4	SCREW PAN HEAD
110CA04-08	---	39	COMMERCIAL	#4-40 X 1/2	SCREW PAN HEAD
110AB04-04	---	40	COMMERCIAL	#2-56 X 1/4	SCREW PAN HEAD
112CB04-01	---	41	COMMERCIAL	#4-40 HEX NUT	#4-40 HEX NUT
109-216-2X	---	49	H. H. SMITH	2161	#6 FIBER WASHER
110DA04-08	---	50	COMMERCIAL	#6-32 X 1/2	SCREW PAN HEAD
111DC04-01	---	51	COMMERCIAL	#6 SPLIT LOCK	#6 LOCK WASHER

COLUMN #1 Elgar Part
COLUMN #2 Reference Designator
COLUMN #3 Item # on Assy Dwg
COLUMN #4 Manufacturer
COLUMN #5 Manufacturer's Part #
COLUMN #6 Description

SECTION 7
DIAGRAMS

7-1. GENERAL

7-2. This section contains the schematic diagrams and parts layout for the 9023 Plug-In Programmer. The schematic diagrams should be used to understand the theory of operation as an aid in troubleshooting the unit. Components identified as 'trim' or 'FSV' are factory selected parts whose values are determined at the time of final checkout.

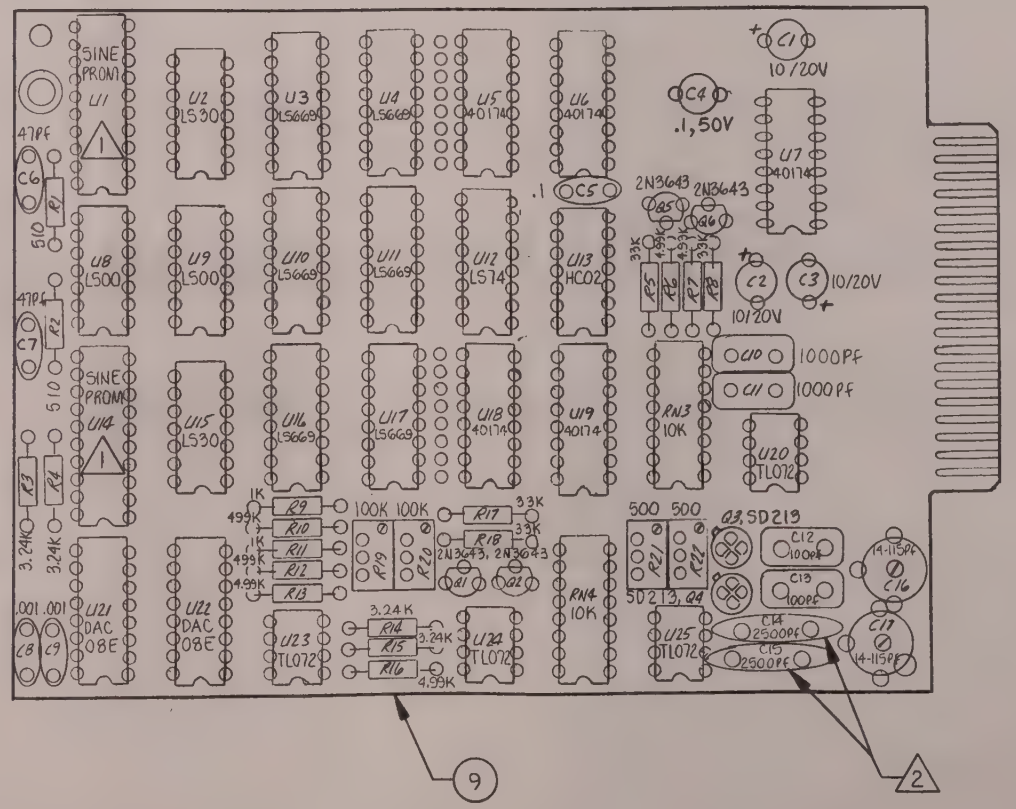
7-3. DIAGRAMS

7-4. Diagrams included in this section are as follows:

5809202-01	ASSY PHASE BOARD	Sht 5 of 5
5809204-01	ASSY PROCESSOR BOARD	Sht 6 of 6
5809201-01	ASSY MAIN BOARD	Sht 7 of 7
5809203-01	ASSY DISPLAY BOARD	Sht 4 of 4
5809205-01	ASSY TEST BOARD	Sht 7 of 7
5809200-01	ASSY FINAL 9023	Sht 5 of 5
5970075-01	ASSY INTERCONN CABLE	Sht 1 of 1
6809202-01	SCHEM PHASE BOARD	Sht 1 of 1
6809204-01	SCHEM PROCESSOR BOARD	Sht 1 of 1
6809201-01	SCHEM MAIN BOARD	Sht 1 of 1
6809203-01	SCHEM DISPLAY BOARD	Sht 1 of 1
6809205-01	SCHEM TEST BOARD	Sht 1 of 1
6809200-01	SCHEM FINAL 9023	Sht 1 of 1

Diagram sheets not included consist of Parts Lists which are covered in Section 6.

REVISIONS				
ZONE	REV.	DESCRIPTION	DATE	APPROVED
		SEE SHEET 1.		



-01 ASSY

QTY REQD	FSCM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	MATERIAL SPECIFICATION
PARTS LIST				

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ARE:
FRACTIONS ± DECIMALS .XX ± .XXX ± ANGLES ±
MATERIAL
FINISH
NEXT ASSY
USED ON
APPLICATION
DO NOT SCALE DRAWING

CONTRACT NO.

APPROVALS	DATE
DRAWN R Rhase	12-29-81
CHECKED	
ISSUED	

5809200-02	PIP9023-3
5809200-01	PIP9023-3T

ELGAR

PRINTED CIRCUIT ASSY, PHASE GENERATOR

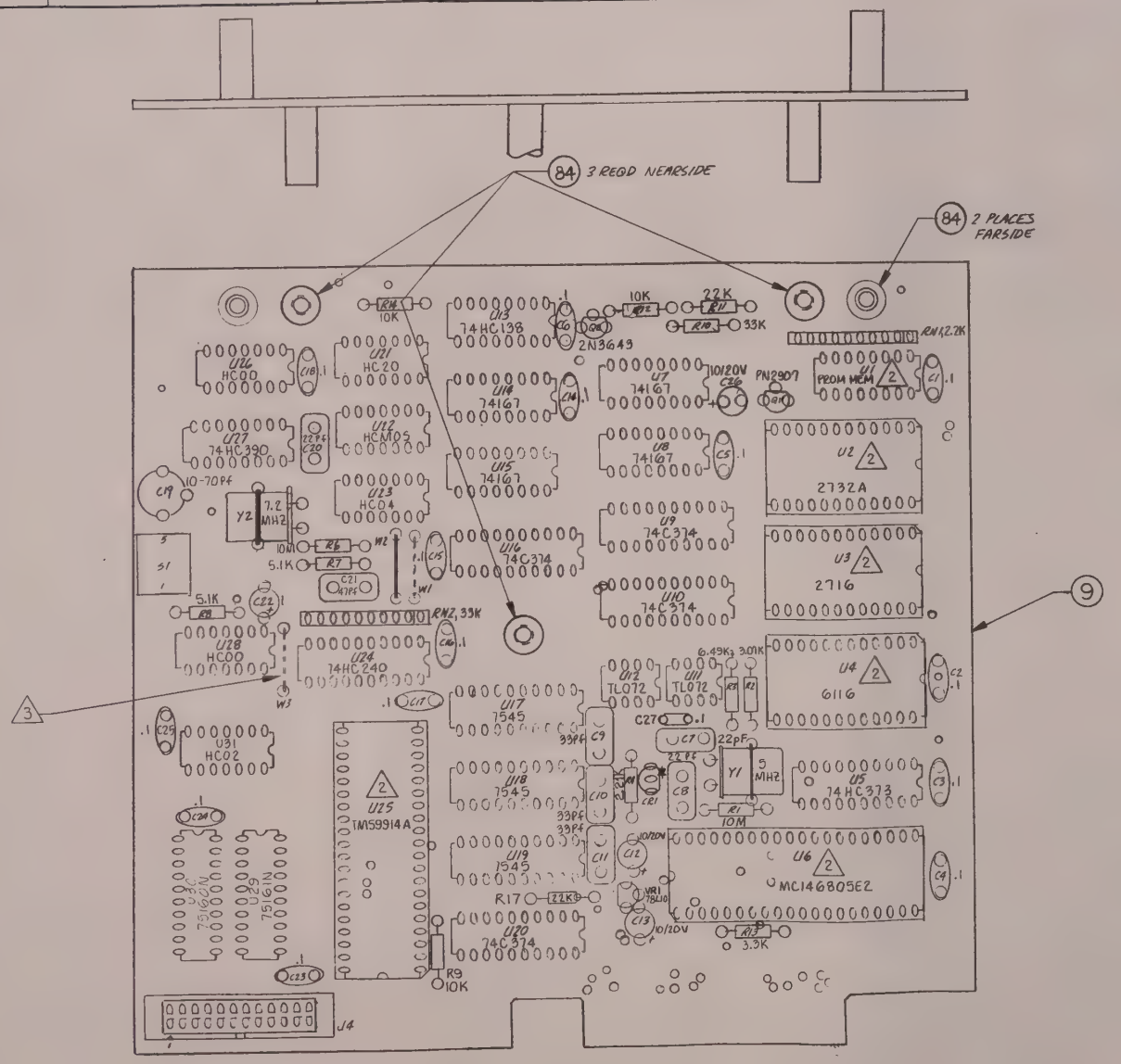
SIZE	FSCM NO.	DWG. NO.	REV.
C	25965	5809202	B

SCALE 2/1 SHEET 5 OF 5

2 DO NOT "LEAD BEND." MOUNT AS CLOSE TO BD AS POSSIBLE.
1 USE DIP SOCKETS.
NOTES: UNLESS OTHERWISE SPECIFIED.

BISHOP GRAPHICS, INC. REORDER NO. 20511

REVISIONS				
ZONE	REV.	DESCRIPTION	DATE	APPROVED
		SEE SHEET 1 "A" SIZE		



-01 ASSY SHOWN

3 DO NOT INSTALL W1 & W3.

2 USE SOCKETS.

1. FOR SCHEMATIC DIAGRAM SEE 6809204-01.

NOTES: UNLESS OTHERWISE SPECIFIED.

QTY REQD	FSCM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	MATERIAL SPECIFICATION
			PARTS LIST	

5809200-02	PIP 9023-3
5809200-01	PIP 9023-3T

NEXT ASSY | USED ON

APPLICATION

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ARE
FRACTIONS DECIMALS ANGLES
± XX ± °
.XXX ±

MATERIAL

FINISH

DO NOT SCALE DRAWING

CONTRACT NO.

APPROVALS	DATE
DRAWN	12-20-85
CHECKED	
ISSUED	

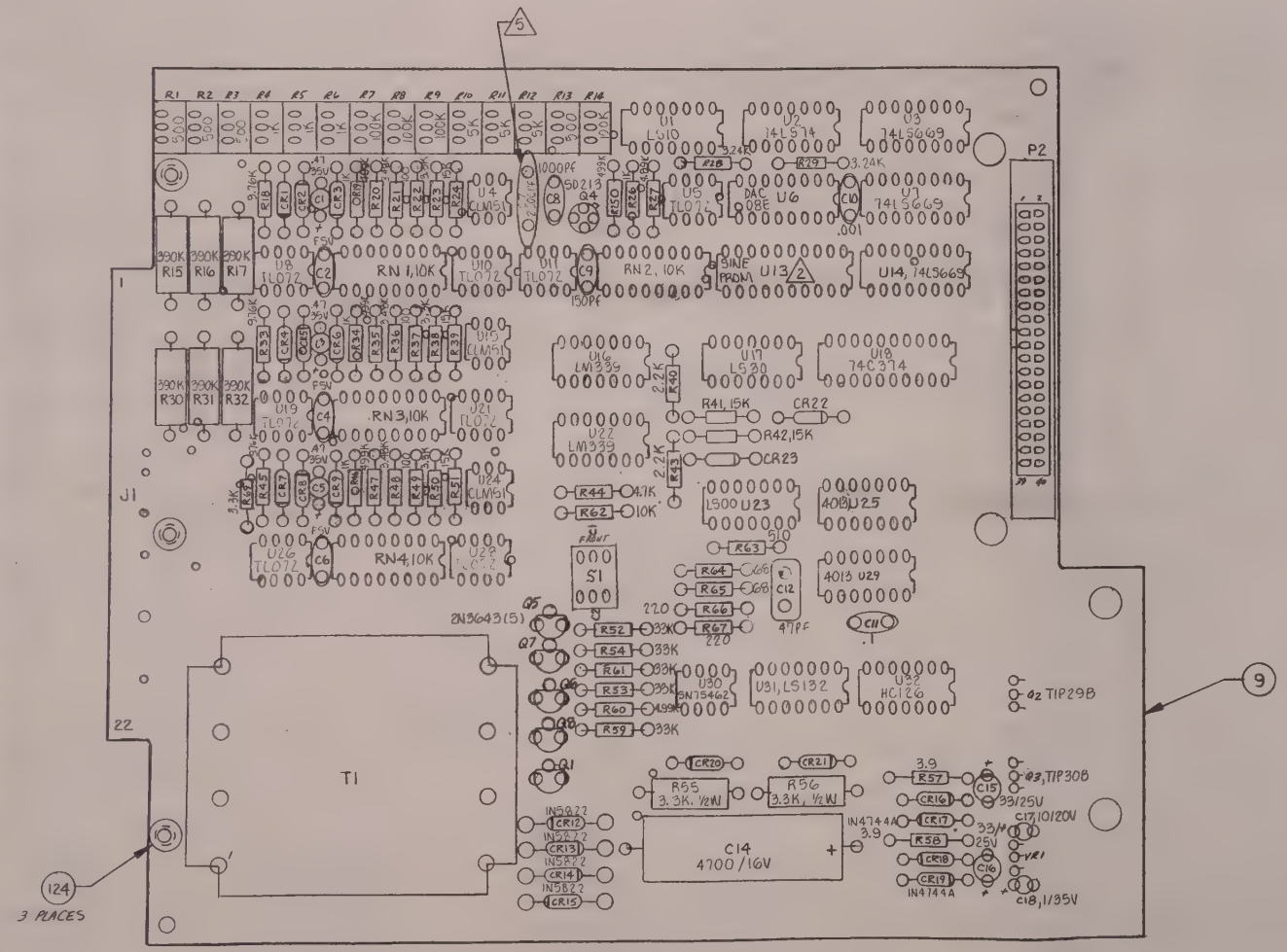
ELGAR

PRINTED CIRCUIT ASSY, MICROPROCESSOR, 9023

SIZE	FSCM NO.	DWG. NO.	REV.
D	25965	5809204	D

SCALE 2/1 SHEET 6 OF 6

REVISIONS				
ZONE	REV.	DESCRIPTION	DATE	APPROVED
		SEE SHEET 1 "A" SIZE		



-01 ASSY SHOWN

5 DO NOT "LEAD BEND". MOUNT AS CLOSE TO PCB AS POSSIBLE.
4. ALL DIODES ARE IN914
3. C2, 4, 6 ARE FSV, OPTIONAL.
2 USE DIP SOCKET.
1. FOR SCHEMATIC DIAGRAM USE 6809201-01.
NOTES: UNLESS OTHERWISE SPECIFIED.

5809200-02	PIP 9023-3
5809200-01	PIP 9023-3T
NEXT ASSY	USED ON
APPLICATION	

QTY REQD	FSCM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	MATERIAL SPECIFICATION
PARTS LIST				

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ARE:
FRACTIONS ± DECIMALS .XX ± .XXX - ANGLES ±

MATERIAL
FINISH
DO NOT SCALE DRAWING

CONTRACT NO.

APPROVALS	DATE
DRAWN	11-11-85
CHECKED	
PROJ ENG	

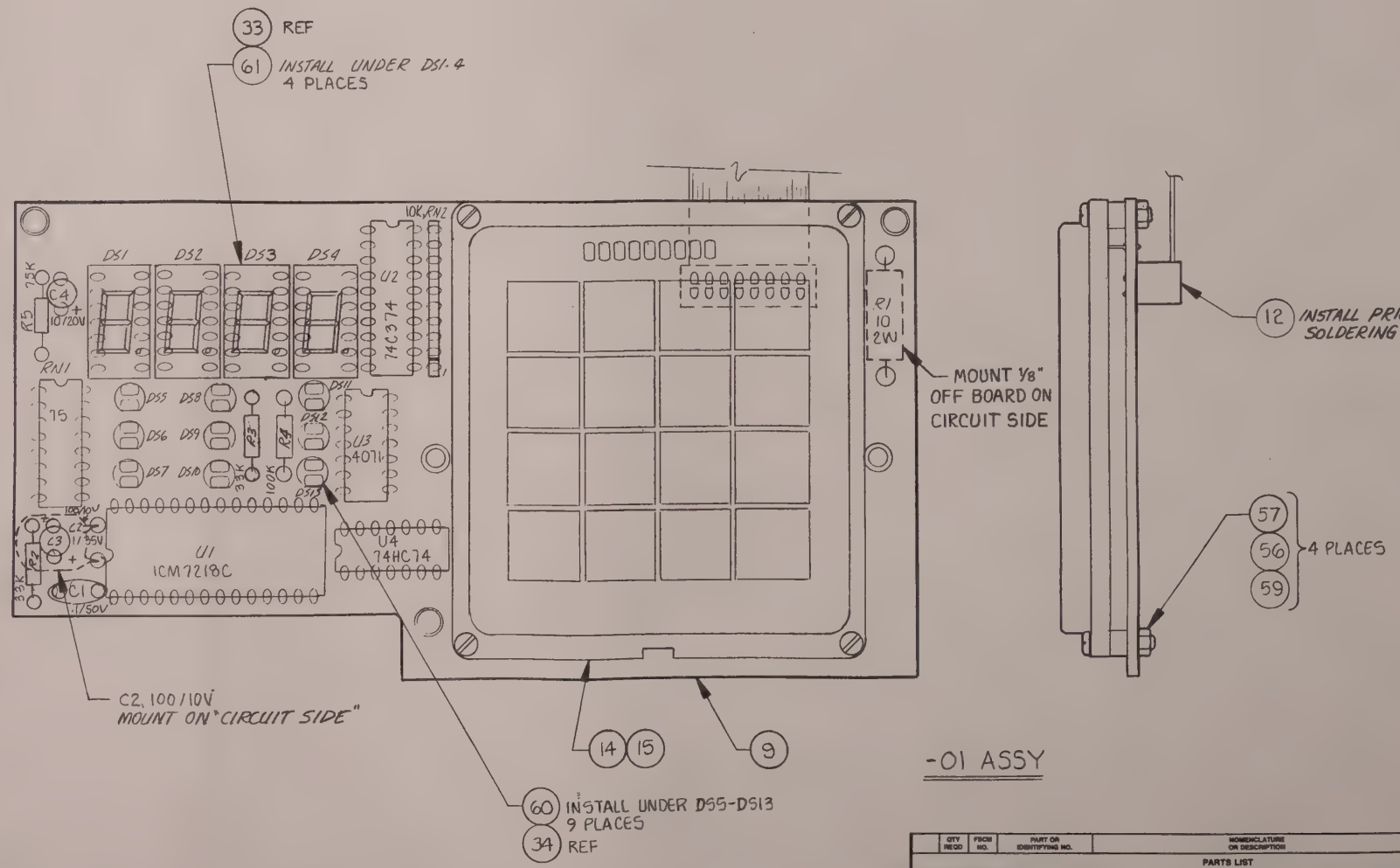
ELGAR

PRINTED CIRCUIT ASSY, MAIN BOARD, 9023

SIZE	FSCM NO.	DWG. NO.	REV.
D	25965	5809201	B

SCALE 2:1 SHEET 7 OF 7

REVISIONS				
ZONE	REV.	DESCRIPTION	DATE	APPROVED
	A	ENG. RELEASE DK 2-10-87	2-11-87	
		SEE SHT. 1 CD		



-01 ASSY

QTY REQD	FSCM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	MATERIAL SPECIFICATION
PARTS LIST				

5809200-02	PIP 9023-3
5809200-01	PIP 9023-3T
NEXT ASSY	USED ON
APPLICATION	

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ARE:
FRACTIONS ± DECIMALS .XX ± .XXX ± ANGLES ±

MATERIAL

FINISH

DO NOT SCALE DRAWING

CONTRACT NO.

APPROVALS	DATE
DRAWN	12-30-85
CHECKED	
D.E.	

ELGAR

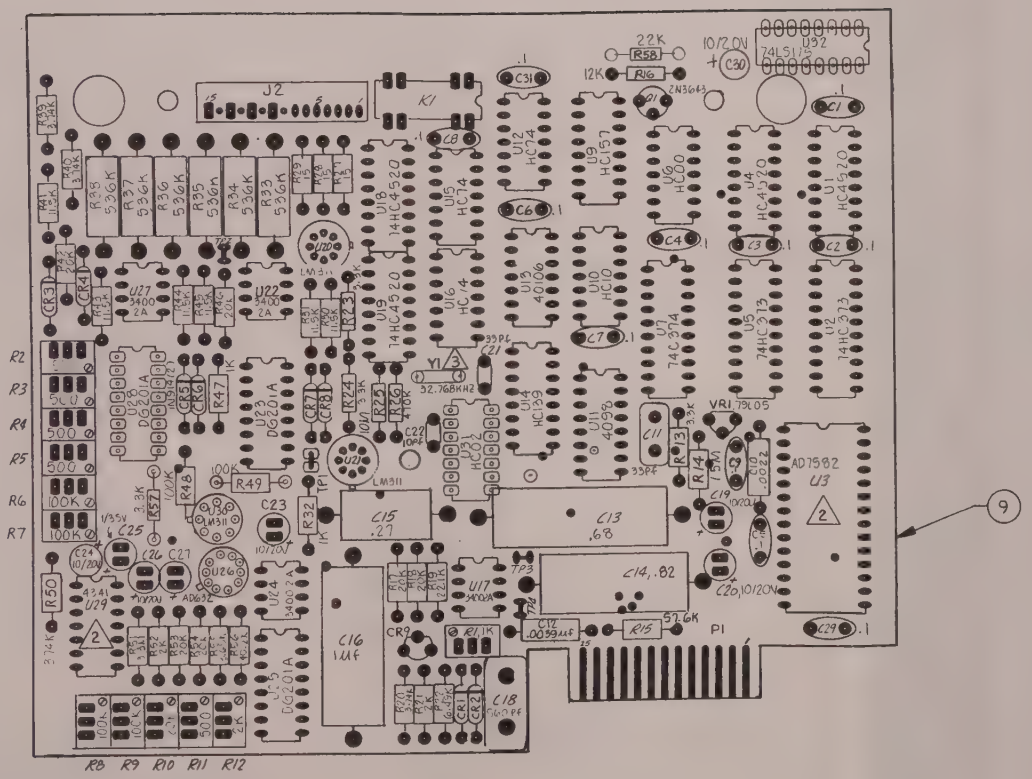
PRINTED CIRCUIT ASSY, DISPLAY

SIZE	FSCM NO.	DWG. NO.	REV.
C	25965	5809203	B

SCALE 2/1 SHEET 4 of 4

BISHOP GRAPHICS, INC.
REORDER NO. 20513

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED
		SEE SHEET 1 "A" SIZE		



-01 ASSY SHOWN

5. ALL DIODES ARE IN914.
4. FOR SCHEMATIC DIAGRAM SEE 6809205-01.
3. INSTALL Y1 AFTER FLOW SOLDER, MOUNT Y1 1/16" OFF BOARD
2. USE SOCKETS.
1. USE 22 AWG BUSS WIRE FOR TP1-4.

NOTES: UNLESS OTHERWISE SPECIFIED.

5809200-01	PIP 9023-3T
NEXT ASSY	USED ON
APPLICATION	

THE INFORMATION DISCLOSED HEREIN WAS ORIGINATED BY AND IS THE PROPERTY OF ELGAR CORPORATION AND EXCEPT FOR RIGHTS EXPRESSLY GRANTED TO THE UNITED STATES GOVERNMENT, ELGAR CORPORATION RESERVES ALL PATENT PROPRIETARY, DESIGN USE SALE MANUFACTURING AND REPRODUCTION RIGHTS THERETO

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON:
DECIMALS FRACTIONS ANGLES
XX ± .03 ± 1/32 ± 1/2°
XXX ± .010
DO NOT SCALE THIS DRAWING

MATERIAL

FINISH:

CONTRACT NO
FIRST MADE FOR

APPROVAL		DATE
DRAWN	R. Rose	3-12-86
CHECKED	M. Mann	3-17-86
PROJ ENG		
QA-REL		

ELGAR

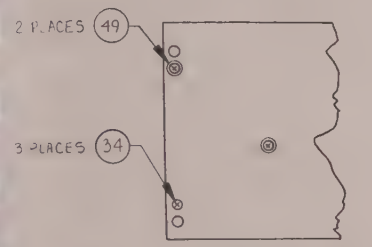
PRINTED CIRCUIT ASSY, TEST BOARD, 9023-3T

SIZE	CODE IDENT NO.	DRAWING NO.	REV
D	25965	5809205	C

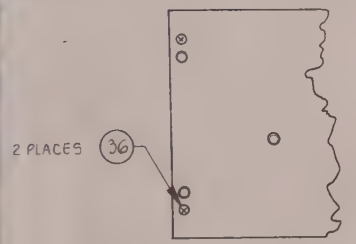
SCALE 2/1 SHEET 7 OF 7

5809205

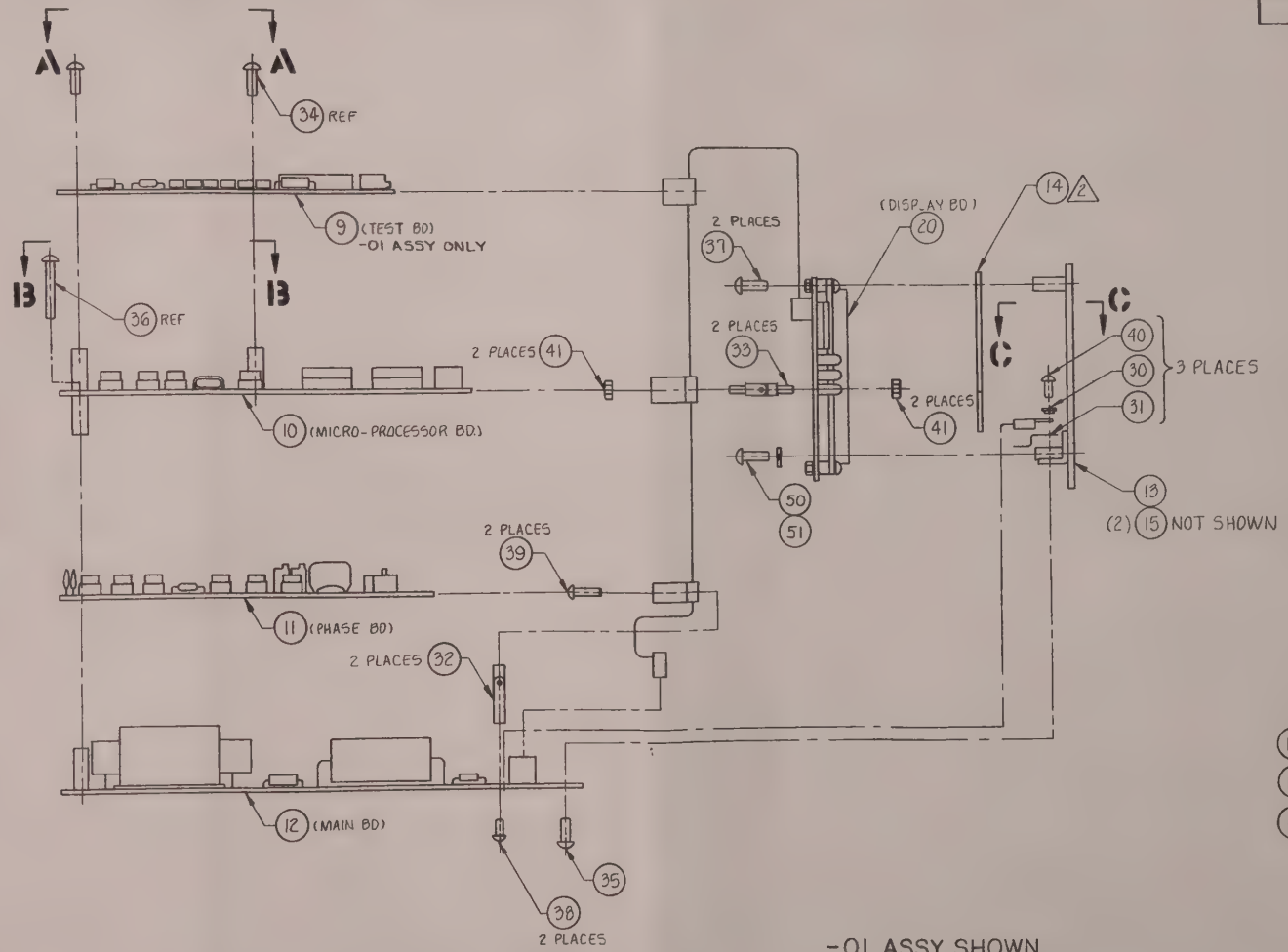
REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED
		SEE SHEET 1 "A" SIZE		

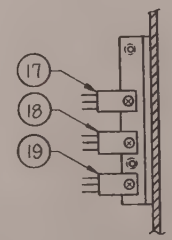


VIEW **A-A**
SCALE: HALF
-01 ASSY ONLY



VIEW **B-B**
SCALE: HALF





SECTION **C-C**

-01 ASSY SHOWN
-02 SAME EXCEPT AS NOTED (3)

(3) ITEM 9 (TEST BD) INSTALLED ON -01 ASSY ONLY.
(2) BOND ITEM 14 TO ITEM 13 USING SUPER BOND LOCTITE #495.
1. APPLY LOCTITE TO SCREWS AND NUTS PRIOR TO INSTALLATION.

NOTES: UNLESS OTHERWISE SPECIFIED.

DASH NO	NEXT ASSY.	USED ON
-02		9023-3
-01		9023-3T

APPLICATION

THE INFORMATION DISCLOSED HEREIN WAS ORIGINATED BY AND IS THE PROPERTY OF ELGAR CORPORATION AND EXCEPT FOR RIGHTS EXPRESSLY GRANTED TO THE UNITED STATES GOVERNMENT ELGAR CORPORATION RESERVES ALL PATENT PROPRIETARY DESIGN USE SALE MANUFACTURING AND REPRODUCTION RIGHTS THEREIN.

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES.
TOLERANCES ON:
DECIMALS FRACTIONS ANGLES
XX ± .03 ± 1/32 ± 1/2°
XXX ± .010
DO NOT SCALE THIS DRAWING

MATERIAL: —

FINISH —

CONTRACT NO
FIRST MADE FOR:

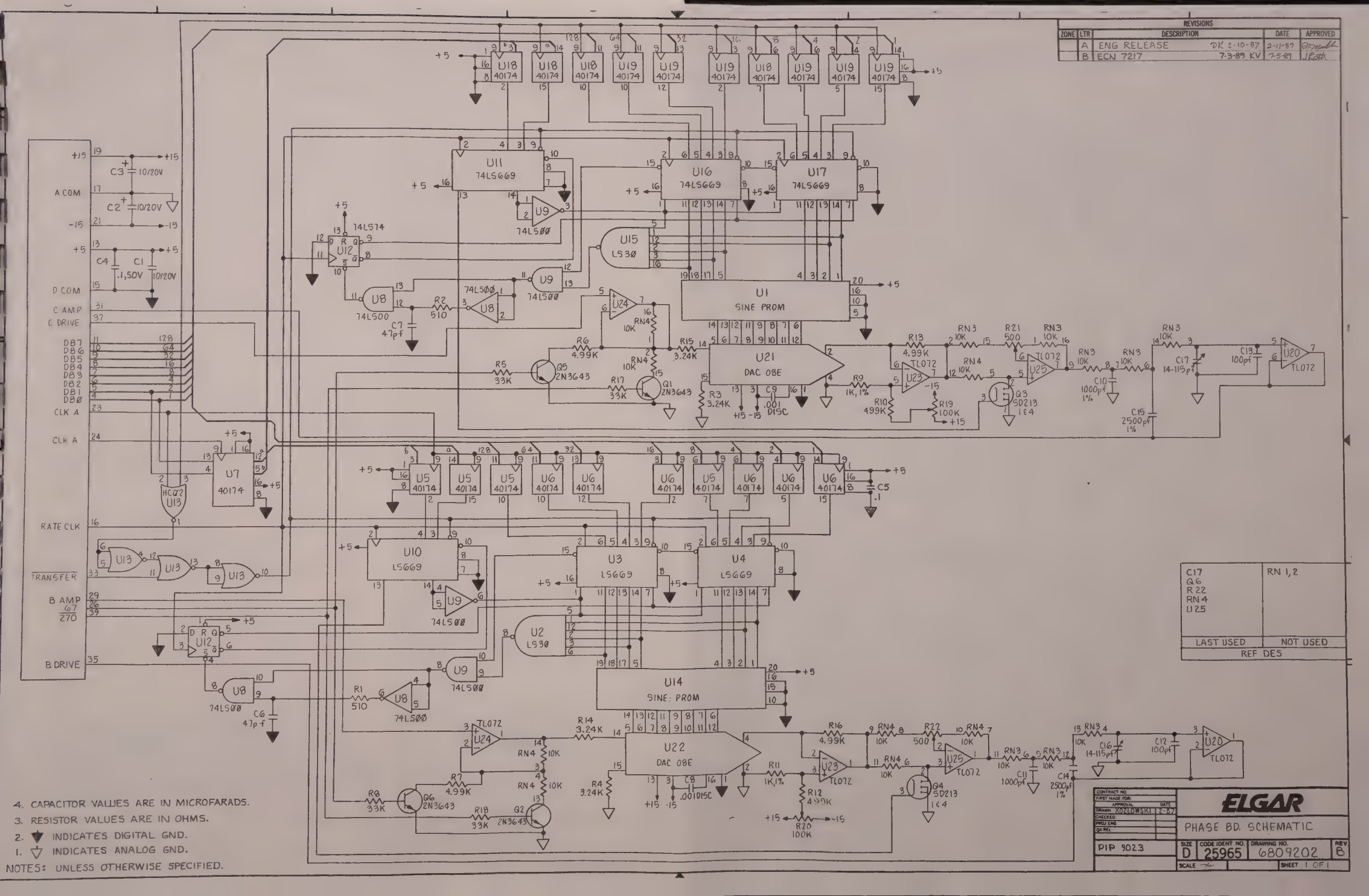
APPROVAL		DATE
DRAWN	C.DEGUZMAN	7-31-86
CHECKED		8-12-86
PROJ ENG		5-29-91
QA-REL		

ELGAR

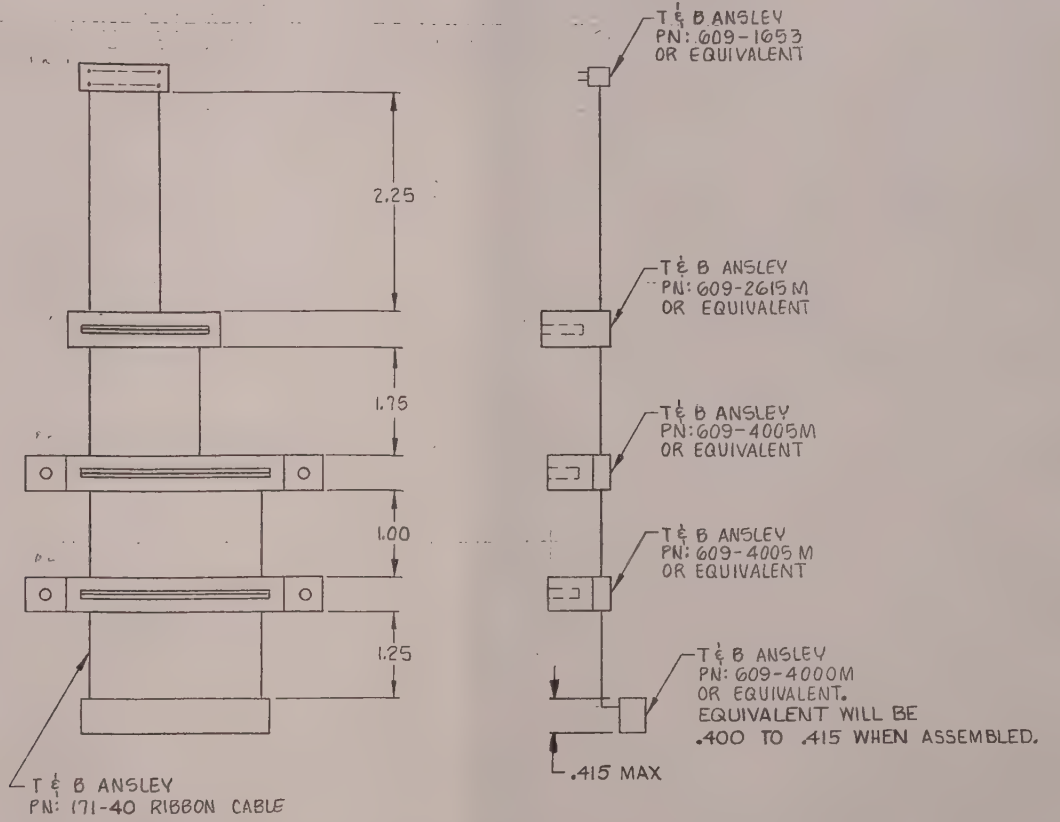
FINAL ASSY
9023 PLUG-IN PROGRAM

SIZE	CODE IDENT NO	DRAWING NO	REV
D	25965	5809200	C

SCALE: 6LL SHEET 2 OF 8


REVISIONS
ZONE | LTR | DESCRIPTION | DATE | APPROVED
A | ENG RELEASE DK 2-10-87 | 2-11-87
B | ECN 7217 7-3-89 KV | 7-5-89 JRoth
+15
-15
+5
A COM
D COM
C AMP
C DRIVE
DB7
DB6
DB5
DB4
DB3
DB2
DB1
DB0
CLK A
CLK A
RATE CLK
TRANSFER
B AMP
B DRIVE
C3 10/20V
C2 10/20V
C4 .1,50V
C1 10/20V
U18 40174
U19 40174
U11 74LS669
U16 74LS669
U17 74LS669
U9 74LS00
U12 74LS74
U8 74LS00
U15 LS30
U1 SINE PROM
U24 TL072
U21 DAC 08E
U23 TL072
U25 TL072
U20 TL072
R2 510
C7 47pf
R6 4.99K
R5 33K
Q5 2N3643
R15 3.24K
RN4 10K
R17 33K
Q1 2N3643
R3 3.24K
C9 .001 DISC
R9 1K, 1%
R10 499K
R19 100K
R13 4.99K
R21 500
RN3 10K
RN4 10K
Q3 SD213 1E4
C10 1000pf 1%
C15 2500pf 1%
C17 14-115pf
C13 100pf
U7 40174
U13 HC02
U5 40174
U6 40174
C5 .1
U10 LS669
U3 LS669
U4 LS669
U2 LS30
U14 SINE PROM
R1 510
C6 47pf
R14 3.24K
R16 4.99K
R22 500
R7 4.99K
R8 33K
Q6 2N3643
R18 33K
Q2 2N3643
R4 3.24K
C8 .001DISC
R11 1K,1%
R12 499K
R20 100K
Q4 SD213 1E4
C11 1000pf
C14 2500pf 1%
C16 14-115pf
C12 100pf
RN 1, 2
C17
Q6
R 22
RN4
U25
LAST USED
NOT USED
REF DES
4. CAPACITOR VALUES ARE IN MICROFARADS.
3. RESISTOR VALUES ARE IN OHMS.
2. ▼ INDICATES DIGITAL GND.
1. ▽ INDICATES ANALOG GND.
NOTES: UNLESS OTHERWISE SPECIFIED.
CONTRACT NO
FIRST MADE FOR:
APPROVAL DATE
DRAWN KOZLOWSKI 2-87
CHECKED
PROJ ENG
QA REL
PIP 9023
ELGAR
PHASE BD. SCHEMATIC
SIZE D
CODE IDENT NO. 25965
DRAWING NO. 6809202
REV B
SCALE
SHEET 1 OF 1

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED
	A	ENG RELEASE DK 2-10-87	2-11-87	
	B	INC ECN 6452 DK 9-4-87	9-8-87	
	C	ECN 7154 4-11-89 KV	4-11-89	



-01 ASSY SHOWN

5809127	9023
NEXT ASSY.	USED ON
APPLICATION	

THE INFORMATION DISCLOSED HEREIN WAS ORIGINATED BY AND IS THE PROPERTY OF ELGAR CORPORATION AND EXCEPT FOR RIGHTS EXPRESSLY GRANTED TO THE UNITED STATES GOVERNMENT, ELGAR CORPORATION RESERVES ALL PATENT, PROPRIETARY, DESIGN, USE, SALE, MANUFACTURING AND REPRODUCTION RIGHTS THEREIN.

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON:
DECIMALS .XX ± .03 .XXX ± .010 | FRACTIONS ± 1/32 | ANGLES ± 1/2°
DO NOT SCALE THIS DRAWING

MATERIAL —

FINISH —

CONTRACT NO.
FIRST MADE FOR:

APPROVAL		DATE
DRAWN	C.DEGUZ	3/6/86
CHECKED		8-26-86
PROJ ENG		
QA REL		

ELGAR

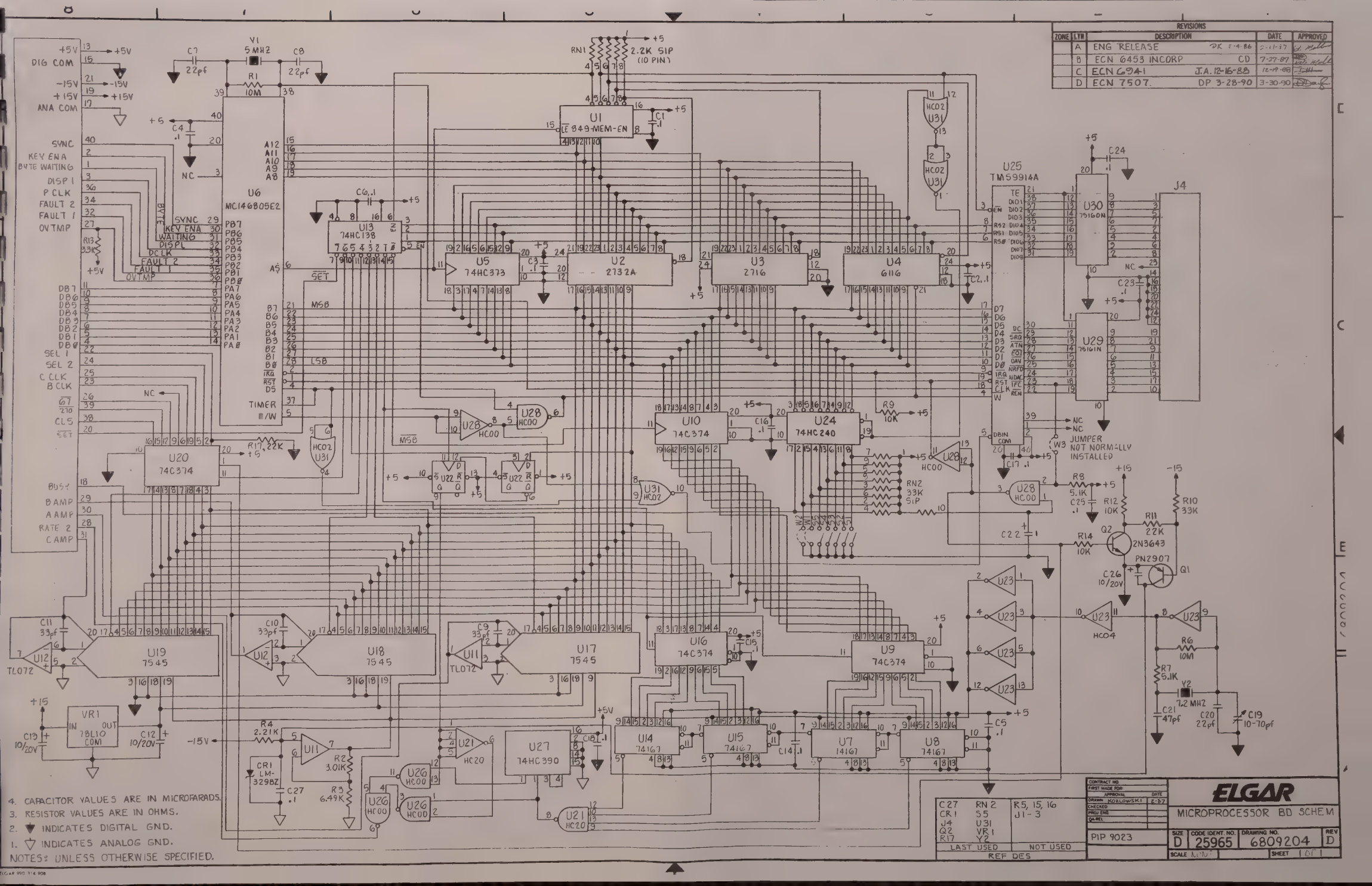
INTERCONNECT CABLE ASSY
SERIES 9023

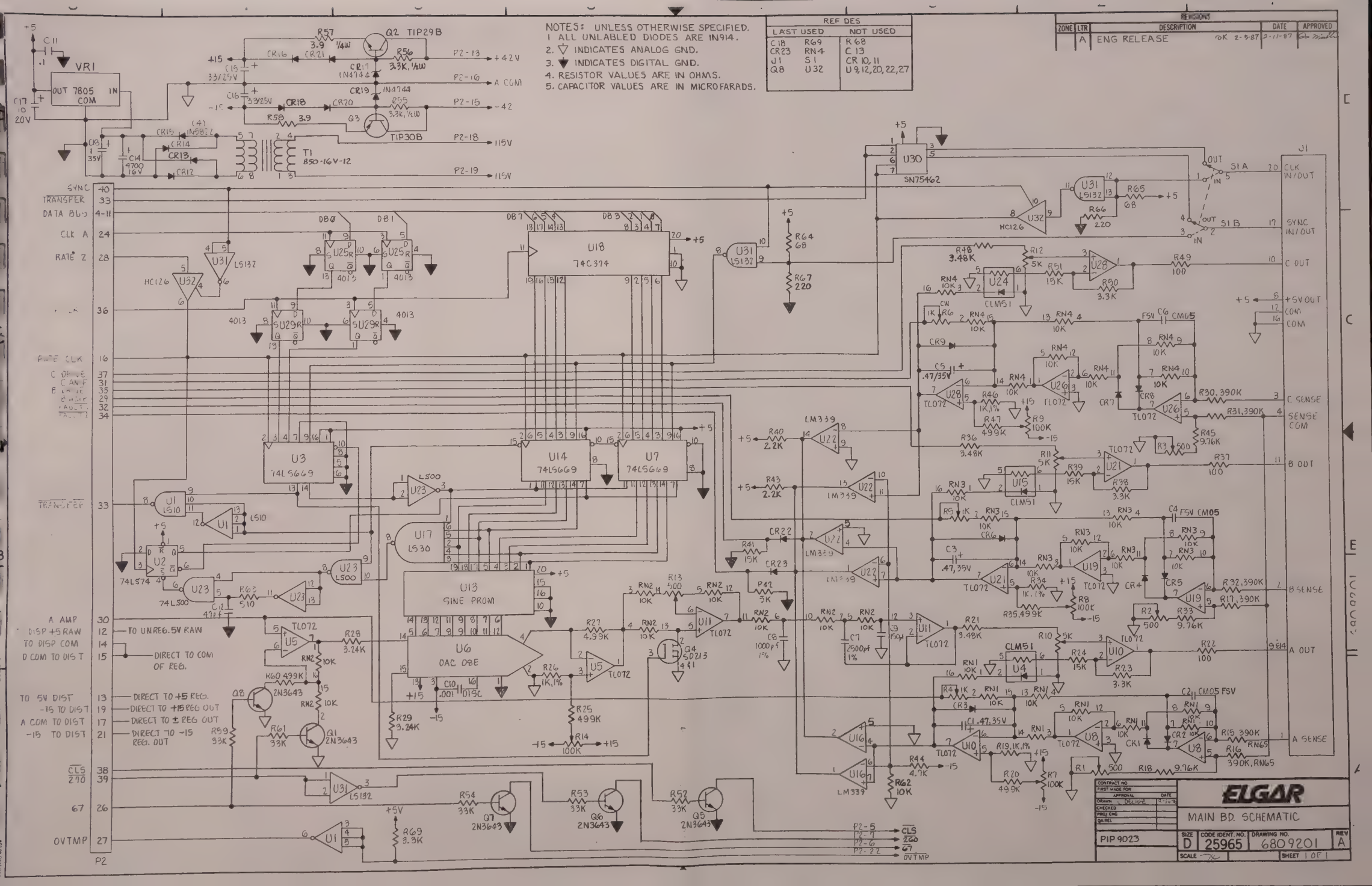
SIZE	CODE IDENT. NO	DRAWING NO	REV
C	25965	5970075	C

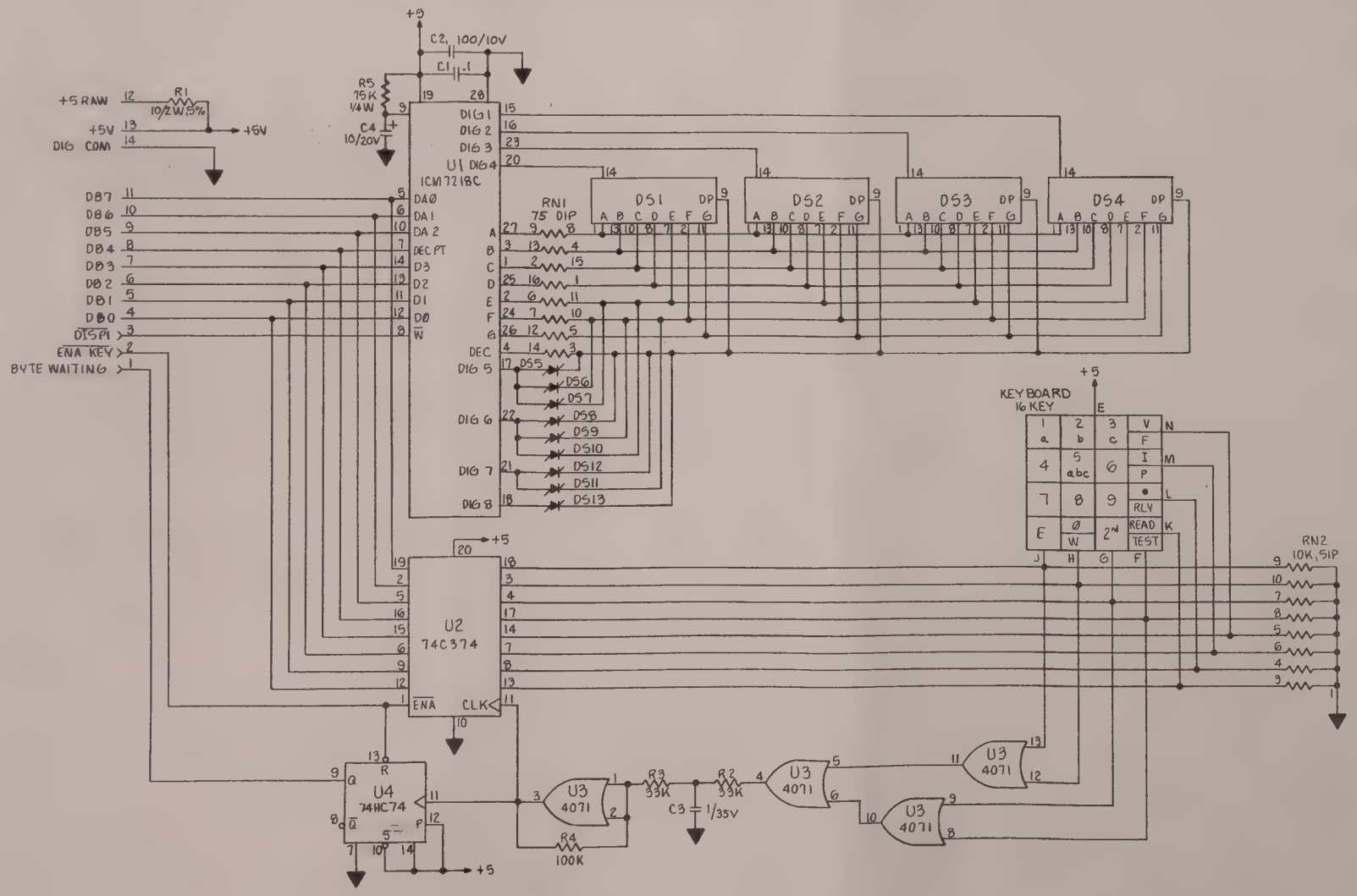
SCALE 1:1 SHEET 1 OF 1

5970075

ELGAR 990 314 90A


REVISIONS
ZONE | LTR | DESCRIPTION | DATE | APPROVED
A | ENG RELEASE DK 8-4-86 | 2-11-87
B | ECN 6453 INCORP CD | 7-27-87
C | ECN 6941 J.A. 12-16-88 | 12-19-88
D | ECN 7507. DP 3-28-90 | 3-30-90
U6 MC146805E2
U1 LE 849-MEM-EN
U2 2732A
U3 2716
U4 6116
U5 74HC373
U10 74C374
U16 74C374
U9 74C374
U20 74C374
U24 74HC240
U25 TMS9914A
U30 75160N
U29 75161N
J4
U19 7545
U18 7545
U17 7545
U14 74167
U15 74167
U7 74167
U8 74167
U27 74HC390
U13 74HC138
RN1 2.2K SIP (10 PIN)
RN2 33K SIP
Y1 5 MHZ
Y2 7.2 MHZ
W3 JUMPER NOT NORMALLY INSTALLED
Q1 PN2907
Q2 2N3643
VR1 78L10 COM
CR1 LM-3298Z
4. CAPACITOR VALUES ARE IN MICROFARADS.
3. RESISTOR VALUES ARE IN OHMS.
2. ▼ INDICATES DIGITAL GND.
1. ▽ INDICATES ANALOG GND.
NOTES: UNLESS OTHERWISE SPECIFIED.
C27 CR1 J4 Q2 R17 RN2 S5 U31 VR1 Y2
R5, 15, 16 J1-3
LAST USED
NOT USED
REF DES
ELGAR
MICROPROCESSOR BD SCHEM
PIP 9023
SIZE D
CODE IDENT. NO. 25965
DRAWING NO. 6809204
REV D
SHEET 1 OF 1


NOTES: UNLESS OTHERWISE SPECIFIED.
1 ALL UNLABLED DIODES ARE IN914.
2. ▽ INDICATES ANALOG GND.
3. ▼ INDICATES DIGITAL GND.
4. RESISTOR VALUES ARE IN OHMS.
5. CAPACITOR VALUES ARE IN MICROFARADS.
REF DES
LAST USED NOT USED
C18 R69 R68
CR23 RN4 C13
J1 S1 CR10, 11
Q8 U32 U9, 12, 20, 22, 27
REVISIONS
ZONE LTR DESCRIPTION DATE APPROVED
A ENG RELEASE DK 2-5-87 2-11-87
ELGAR
MAIN BD. SCHEMATIC
PIP 9023
SIZE D CODE IDENT. NO. 25965 DRAWING NO. 6809201 REV A
SCALE SHEET 1 OF 1
P2
J1
VR1
OUT 7805 COM IN
T1 850-16V-12
U3 74LS669
U14 74LS669
U7 74LS669
U18 74C374
U13 SINE PROM
U6 DAC 08E
U17 LS30
U30 SN75462
U32 HC126
U31 LS132
U23 LS00
U2 74LS74
U1 LS10
U5 TL072
U10 TL072
U11 TL072
U19 TL072
U21 TL072
U26 TL072
U28 TL072
U22 LM339
U4 CLM51
U15 CLM51
U24 CLM51
U25R 4013
U29R 4013
Q1 2N3643
Q2 TIP29B
Q3 TIP30B
Q4 SD213
Q5 2N3643
Q6 2N3643
Q7 2N3643
Q8 2N3643
SYNC
TRANSFER
DATA BUS
CLK A
RATE Z
PWR CLK
TRANSFER
A AMP DISP +5 RAW
TO DISP COM
D COM TO DIST
TO 5V DIST
-15 TO DIST
A COM TO DIST
-15 TO DIST
OVTMP
TO UNREG. 5V RAW
DIRECT TO COM OF REG.
DIRECT TO +5 REG.
DIRECT TO +15 REG OUT
DIRECT TO ± REG OUT
DIRECT TO -15 REG. OUT
CLK IN/OUT
SYNC IN/OUT
C OUT
+5V OUT
COM
C SENSE
SENSE COM
B OUT
B SENSE
A OUT
A SENSE
+42V
A COM
-42
115V
115V



3. CAPACITOR VALUES ARE IN MICROFARADS.
2. RESISTOR VALUES ARE IN OHMS.
1. ▼ INDICATES DIGITAL GND.

NOTES: UNLESS OTHERWISE SPECIFIED.

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED
	A	ENG RELEASE DK 2-10-87	2-11-87	

C4	
DS13	
R5	
RN2	
U4	
LAST USED	NOT USED
REF DES	

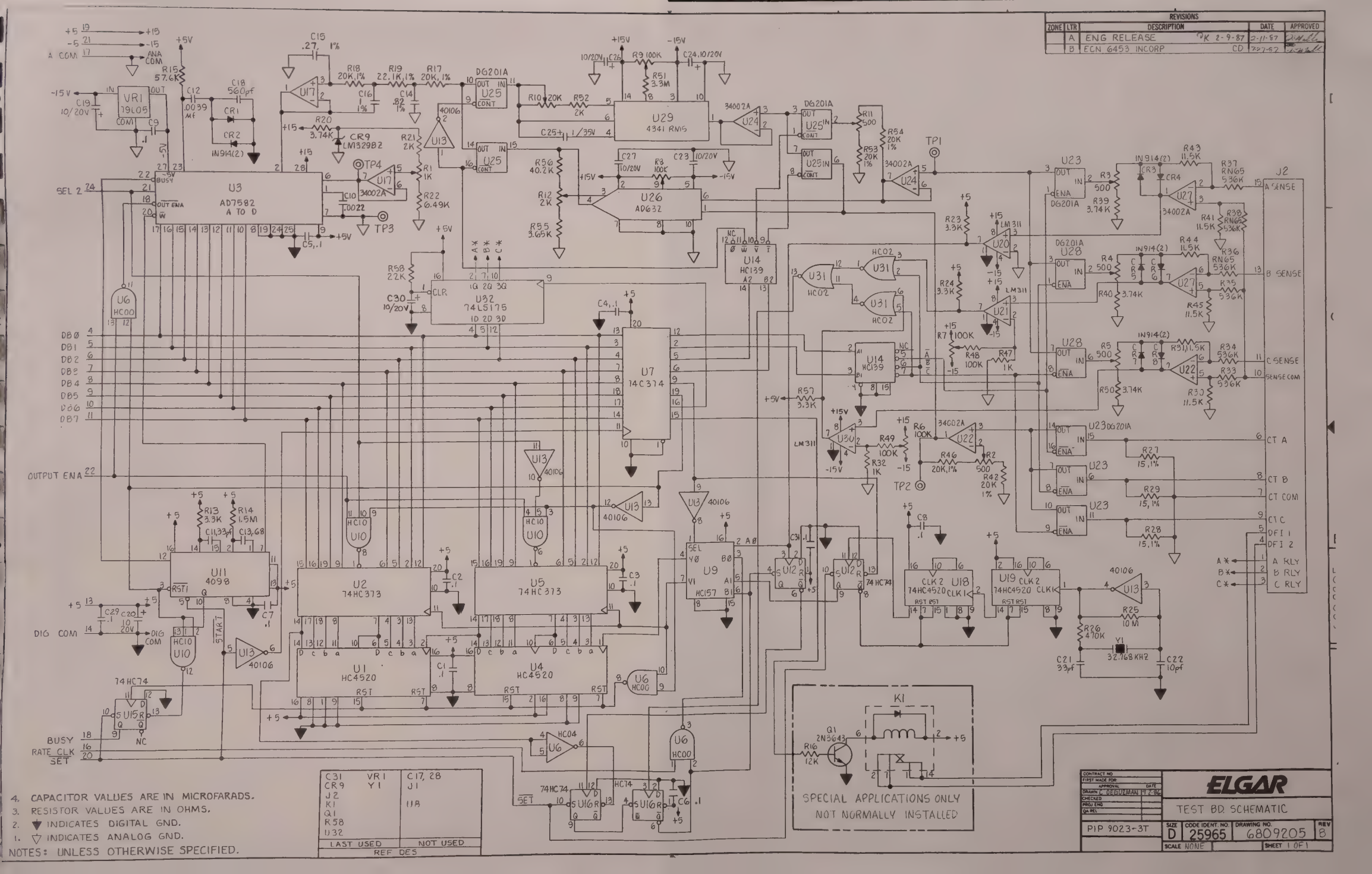
CONTRACT NO.	
FIRST MADE FOR	
APPROVAL / DATE	
Drawn: DEGUZMAN 2/7/86	
CHECKED	
PROJ ENG	
QA REL	
PIP 9023	

ELGAR

DISPLAY BD. SCHEMATIC

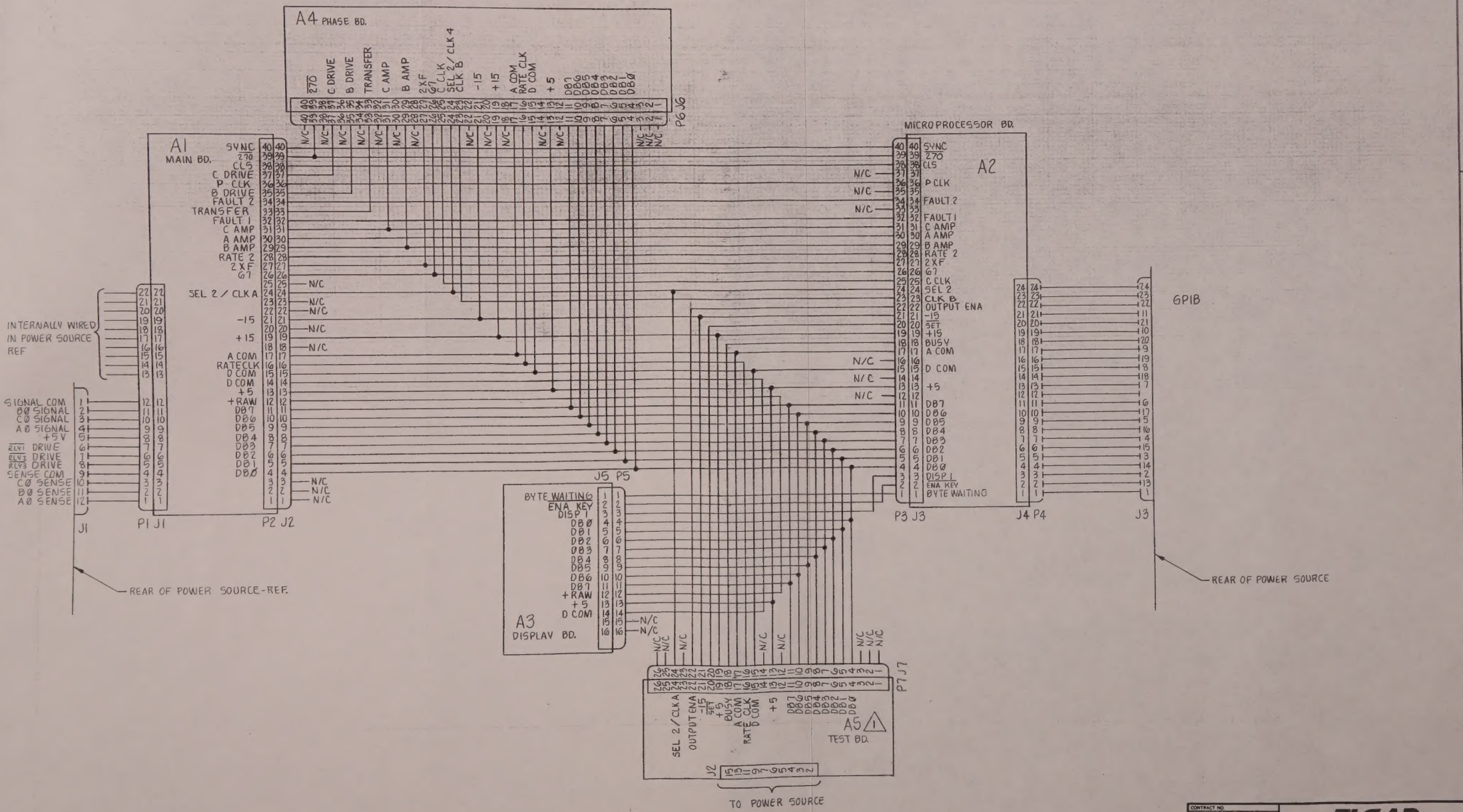
SIZE	CODE IDENT. NO.	DRAWING NO.	REV
D	25965	6809203	A

SCALE NONE SHEET 1 OF 1


REVISIONS
ZONE | LTR | DESCRIPTION | DATE | APPROVED
A | ENG RELEASE PK 2-9-87 | 2-11-87
B | ECN 6453 INCORP CD | 7-27-87
U3 AD7582 A TO D
U26 AD632
U29 4341 RMS
U7 74C374
U11 4098
U2 74HC373
U5 74HC373
U1 HC4520
U4 HC4520
U9 HC157
U32 74LS175
U14 HC139
U18 74HC4520
U19 74HC4520
U27
U28
U22
U21
U20
U30
U31
U12 74HC74
U15 74HC74
U16 74HC74
U10 HC10
U6 HC00
U13 40106
U24 34002A
U25 DG201A
U23 DG201A
U17 34002A
VR1 79L05
K1
Q1 2N3643
Y1 32.768 KHZ
J2
A SENSE
B SENSE
C SENSE
SENSE COM
CT A
CT B
CT COM
CT C
DFI 1
DFI 2
A RLY
B RLY
C RLY
DB0
DB1
DB2
DB3
DB4
DB5
DB6
DB7
OUTPUT ENA
BUSY
RATE CLK
SET
SEL 2
A COM
DIG COM
SPECIAL APPLICATIONS ONLY
NOT NORMALLY INSTALLED
TEST BD SCHEMATIC
ELGAR
PIP 9023-3T
SIZE D
CODE IDENT. NO. 25965
DRAWING NO. 6809205
REV B
SCALE NONE
SHEET 1 OF 1
DRAWN C. DEGUZMAN 9-2-86
C31 VR1 C17, 28
CR9 Y1 J1
J2 11B
K1
Q1
R58
U32
LAST USED NOT USED
REF DES
4. CAPACITOR VALUES ARE IN MICROFARADS.
3. RESISTOR VALUES ARE IN OHMS.
2. ▼ INDICATES DIGITAL GND.
1. ▽ INDICATES ANALOG GND.
NOTES: UNLESS OTHERWISE SPECIFIED.

DATE APPROVED

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED
	A	ENG RELEASE OK 2-11-87	2-10-87	



⚠1 TEST BD INSTALLED ON -01 ASSY ONLY.

NOTES: UNLESS OTHERWISE SPECIFIED.

CONTRACT NO.		
FIRST MADE FOR:		
APPROVAL		DATE
DRAWN	LEGUZMAN	5/15/86
CHECKED		
PROJ. ENG		
QA REL		

ELGAR

INTERCONNECT DIAGRAM
PIP SERIES 9023

SIZE	CODE IDENT. NO.	DRAWING NO.	REV
D	25965	6809200	A

SCALE NONE SHEET 1 OF 1

A8 000 314 908

MP MASTER
MA29339